FINAL

Coal Combustion Waste Impoundment
Round 7 - Dam Assessment Report

Sioux Power Station

Ameren Missouri
St. Charles County, Missouri

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

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Revised

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion residue from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land and damaged homes and property, is a wake-up call for diligence on coal combustion residue disposal units. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the Ameren Missouri Sioux Power Station Plant Fly Ash Dam management unit and the Bottom Ash Dam management unit is based on a review of available documents and on the site assessment conducted by Dewberry personnel on Thursday, September 30, 2010. We found the supporting technical documentation inadequate (Section 1.1.3). As detailed in Section 1.2.5, there are recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Ameren Missouri Sioux Fly Ash Pond dam is **SATISFACTORY** for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

The Ameren Missouri Sioux Bottom Ash Pond dam is **SATISFACTORY** as of September 2011. In 2011 Ameren Missouri installed an inverted filter and buttressed the dike along an existing seepage area. Re-calculations of the safety of this dike demonstrated it now meets Minimum Factors of Safety under both static and seismic conditions.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

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In early 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units (See Appendix C).

The purpose of this report is **to evaluate the condition and potential of waste release from management units and to determine the hazard classification**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. During the inspection it was noted that an Embankment Stability Analysis was currently under way and the results would be available by the end of the year. USEPA requested a copy of the analysis to determine the stability of the embankments for both the fly ash and bottom ash ponds. The additional information could potentially change the ratings in the Final report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment", "berm", "dike" and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, September 30, 2010, and review of technical documentation provided by Ameren Missouri Power Company.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The fly ash and bottom ash pond embankments did not visually appear to have significant structural concerns during the site visit. Furthermore, the Ameren Missouri weekly, annual and special inspection reports show no record of serious structural instability.

A slope stability analysis conducted in November 2010 shows the Fly Ash Pond meets the MDNR and the Corps of Engineers minimum required Factor of Safety for steady seepage loading and seismic loading (Reitz & Jens, Inc., November 2010). Therefore, the structural soundness of the Fly Ash Pond dam is rated **SATISFACTORY.**

However, study results showed the Bottom Ash Pond dam did not meet the minimum required Factor of Safety for Full Reservoir, Steady Seepage loading. The rating was 1.4 which is below the 1.5 minimum. This point of concern was attributed to the west side of the Bottom Ash Pond. As noted in the 2010 report, there is seepage from one concentrated area along the west embankment. Ameren began monitoring this location on a weekly basis. Reitz & Jens, Inc. in the 2010 stability report (Appendix A – Doc 06) recommended a project to improve the west dike such that the Bottom Ash Pond could meet minimum factors of safety.

In 2011 Ameren Missouri carried out the recommendations from the 2010 report. In September 2011, the utility completed installation of an inverted filter along the seepage area and provided new calculations of static loading slope stability (see Appendix A – Doc 07). The slope stability analysis shows that there is an Acceptable Factor of Safety of 1.64 under static conditions using the new configuration. The Bottom Ash Pond dam rating is therefore changed to **SATISFACTORY**.

Table 1.1: Structural Stability Rating	
Category	**Description**
Satisfactory	No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.
Fair	Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.
Poor	A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.
Unsatisfactory	Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

Modified from the New Jersey Department of Environmental Protection Dam Safety Guidelines for the Inspection of Existing Dams, January 2008.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

A hydrologic/hydraulic evaluation of the ponds was conducted by Reitz & Jens, Inc. in August 2007. According to their study, there is sufficient storage capacity for the 100-year, 24-hour rain event when the pool elevation is maintained below an elevation of 440.5 feet for the Bottom Ash Pond and 440 feet for the Fly Ash Pond. No hydrologic/hydraulic safety information was provided relative to the Mississippi River and floodplain. As a result, the supporting technical documentation for hydrologic/hydraulic safety is adequate for the scenario evaluated, but could be improved by conducting a hydrologic/hydraulic safety analysis related to flooding from the Mississippi River.

Ameren Missouri personnel indicated the embankments are continually monitored and no dam safety concerns were observed associated with the Spring 2011 flooding of the Mississippi River (caused by heavy rains and snowmelt).

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

Supporting technical documents are limited. No other technical documentation about the design of the existing facility is available. Technical documents to verify the adequacy of the pond storage, and outlet structures are not available. An Ash Pond Dam Stability Analysis, conducted by Reitz & Jens, Inc., was provided to verify the structural stability of the embankments.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management units (Fly Ash and Bottom Ash) provided by Ameren Missouri were an accurate representation of what Dewberry observed in the field. Descriptions were obtained from documentation provided by Ameren Missouri in their response letters, which are attached to this report. Some items that were provided by Ameren Missouri were stamped "Confidential" and are not included as attachments. These confidential items were used to prepare for the field investigation and as source materials for this report. Items included in this report which are stamped "Confidential" were included with the permission of Ameren to use as support to the report conclusions.

1.1.5 Conclusions Regarding the Field Observations

Dewberry staff was provided access to all areas in the vicinity of the management units required to conduct a thorough field observation. The visible parts of the embankment dikes and outlet structures were observed for signs of overstress, significant settlement, shear failure, and other signs of instability. Visual observations were hampered by a wet low area south of the Fly Ash Pond dam that prevented an inspection of the toe area of that unit. Some erosion areas were observed with the Fly Ash management unit. Rip-rap has been added to those areas to enhance stability. The areas are monitored weekly by Ameren Missouri. A small seep in the northeast corner of the Bottom Ash Pond dam was observed 75' from the toe of the embankment with clear water exiting the area. Ameren Missouri has initiated a project to install an inverted filter along the seepage area and plans to implement the project in 2011. Ameren is monitoring the situation on a weekly basis. There is a channel that flows along the west side of the Bottom Ash Pond embankment. That bank is monitored weekly by Ameren Missouri from the other side of the stream

to see if erosion or wave actions are affecting the integrity of the embankment.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operations appear to be adequate for both the Fly Ash and Bottom Ash units. There was no evidence of significant repairs or prior releases observed during the field inspection. Vegetation on the embankments, and at the toe of the embankments, should be maintained on a regular basis to ensure easy visual observation of the integrity of the embankment structures.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate. According to Ameren Missouri's Dam Safety Program for Non-Hydroelectric Facilities and information learned during the site visit, the Sioux Station embankments receive weekly routine inspections and an annual inspection.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The classification of both the Fly Ash Pond dam and Bottom Ash Pond dam is **SATISFACTORY** for continued safe and reliable operation, as of September 2011. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

It is recommended that Ameren Missouri monitor the west side dike of the Bottom Ash Pond for at least a year to ensure seepage has stopped following completion of the dike improvements.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

No recommendations appear warranted at this time.

1.2.3 Recommendations Regarding the Field Observations

Continue monitoring the western portion of the Bottom Ash Pond embankment for signs of erosion or wave action by the adjacent channel.

1.2.4 Recommendations Regarding the Maintenance and Methods of Operation

Continue to maintain existing embankment slopes to keep vegetation controlled and to allow for easy visual inspection of the dams.

1.2.5 Recommendations Regarding Continued Safe and Reliable Operation

No recommendations appear warranted at this time.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

James Filson, P.E., Dewberry & Davis, LLC
Jeffrey Crabtree, P.E., Dewberry & Davis, LLC
Paul Pike, Ameren Missouri
Matthew Frerking, P.E., Ameren Missouri
Michael Tomasovic, Ameren Missouri

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on September 30, 2010.

Jeffrey Crabtree, P.E. 6-1-2011
Registered, MO E-2001000889

James Filson, P.E.

2.0 DESCRIPTION OF THE COAL COMBUSTION WASTE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The Plant is located along the south bank of a large bend of the Mississippi River in Saint Charles County near West Alton, Missouri, approximately 20 miles upstream of downtown Saint Louis. The Plant is operated by Ameren Missouri. The Fly Ash pond is located in the southern portion of the property and outfalls west to Poeling Lake, which is located in the southwest corner of the site. Under normal Mississippi River levels, water from the lake drains north to Brick House slough, which is adjacent to the Mississippi River. The Bottom Ash Pond is located in the northwestern portion of the Ameren Missouri Sioux site and drains west to Poeling Lake as well. The Bottom Ash Pond outfall is located approximately 1,400 feet northwest of the Fly Ash Pond outfall.

Table 2.1: Summary of Dam Dimensions and Size	
	Fly Ash Pond
Dam Height (ft)	21
Crest Width (ft)	Varies (30-75)
Length (ft)	7,675
Side Slopes (upstream) H:V	3:1
Side Slopes (downstream) H:V	2:1
Hazard Classification (per MDNR guidelines)	III
	Bottom Ash Pond
Dam Height (ft)	28
Crest Width (ft)	Varies (50-150)
Length (ft)	6,600
Side Slopes (upstream) H:V	2:1
Side Slopes (downstream) H:V	2:1
Hazard Classification (per MDNR guidelines)	III

2.2 SIZE AND HAZARD CLASSIFICATION

The impoundment area for the Fly Ash Pond is approximately 60 acres. The Fly Ash Pond was constructed in the 1990's and is lined with a 60-mil high-density polyethylene (HDPE) liner. The impoundment area for the Bottom Ash Pond is approximately 47 acres. It was constructed in the 1960's and is comprised of compacted earth fill. The Bottom Ash pound is not lined.

The classification for size, based on the height of the embankment and the impoundment storage capacity is "Small" for both the Fly Ash Pond and the Bottom Ash Pond utilizing the size classifications below.

Table 2.2a: USACE ER 1110-2-106 Size Classification		
	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

The Environmental Zone Classification, per MDNR Division 22 Reservoir Safety Council Rules and Regulations, is Class III for both the Fly Ash Pond and Bottom Ash Pond. There are no residences, public buildings, campgrounds, industrial buildings, or water/sewer/electrical services for several miles downstream along the Mississippi River.

Table 2.2b: Environmental Zone Classification (per MDNR Division 22 Reservoir Safety Council Rules and Regulations)	
Class I	10 or more permanent dwellings or any public building downstream.
Class II	1-9 permanent dwellings, 1 or more campgrounds with permanent water, sewer and electrical services or 1 or more industrial buildings downstream.
Class III	Everything else.

Dewberry conducted a qualitative hazard classification based on the Federal Guidelines for Dam Safety, dated April 2004, and determined that the hazard potential for catastrophic failure of both dam embankments would be Significant for both ponds.

There are no residences for several miles downstream along the Mississippi River; therefore, the loss of human life is not probable in the event of a catastrophic dam failure. However, if a catastrophic failure would occur the results would be a release of bottom ash and untreated slurry water into the Mississippi River, resulting in environmental losses.

Table 2.2c: FEMA Federal Guidelines for Dam Safety Hazard Classification		
	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

As a result, Dewberry rates the Fly Ash Pond as "Low" for potential hazard based on and field adjacent to the embankment and it do not flow directly into the Mississippi River. The Bottom Ash Pond as "Significant" for hazard potential because if there was a failure the embankments are adjacent to the Mississippi River. Ameren Missouri personnel indicated the embankments are continually monitored and no dam safety concerns were observed associated with the Spring 2011 flooding of the Mississippi River (caused by heavy rains and snowmelt).

2.3 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

Information on the amount of residuals or the volume of the ash ponds are provided in Table 2.3:

Table 2.3: Maximum Capacity of Unit	
Fly Ash Pond	
Surface Area (acre)[1]	60
Current Storage Capacity (cubic yards)	1,090,613
Current Storage Capacity (acre-feet)[1]	676
Total Storage Capacity (cubic yards)	1,548,800
Total Storage Capacity (acre-feet)[1]	960
Crest Elevation (feet)[3]	441.2 to 444.3
Normal Pond Level (feet)[2]	440
Bottom Ash Pond	
Surface Area (acre)[1]	47
Current Storage Capacity (cubic yards)	2,999,187
Current Storage Capacity (acre-feet)[1]	1,859
Total Storage Capacity (cubic yards)	3,388,000
Total Storage Capacity (acre-feet)[1]	2,100
Crest Elevation (feet)[3]	442.6 to 445.5
Normal Pond Level (feet)[2]	434

[1] *Information provided in May 4, 2009 Ameren Missouri response letter to request for more information.*

[2] *Information found in Reitz & Jens, Inc. Phase I Report 2007012405 for Sioux Plant, dated August 27, 2007, provided by Ameren Missouri.*

[3] *Information found in Reitz & Jens, Inc. Ash Pond Dam Stability Analysis for Sioux Plant, dated November 16, 2010, provided by Ameren Missouri.*

2.4 PRINCIPAL PROJECT STRUCTURES

2.4.1 Earth Embankment

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Fly Ash Pond dam was constructed in the 1990's. The upstream slopes of the Fly Ash dam are constructed of compacted earth fill at 3:1 Horizontal:Vertical (H:V) slopes and are lined with a 60-mils HDPE liner. The upstream slopes were constructed from the top and over the slopes of an existing railroad and roadway embankment. The existing slopes of the railroad and roadway embankments are typically 2:1 H:V slopes and form the downstream slopes. A short section at the northwest corner of the dam was constructed with new downstream slopes at 3:1 H:V. The dam embankment is 7,675 feet long and approximately 21 feet high. A structural analysis was recently conducted and the results should be available in late 2010.

The Bottom Ash Pond dam was constructed in the 1960's and consists of compacted earth fill at 2:1 H:V slopes. The pond is unlined. The dam embankment is 6,600 feet long and approximately 28 feet high. A structural analysis was recently conducted and the results should be available in late 2010. Rip-rap has been added to the interior and exterior slopes of the Bottom Ash Pond dam to enhance stability and prevent erosion. For the interior, rip-rap has been placed along the northern and northeastern slopes. On the exterior, rip-rap has been placed along the entire southwestern slope and along the northern slope.

No data was provided regarding the initial geotechnical design assumptions or construction criteria used for either dam.

2.4.2 Outlet Structures

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Fly Ash Pond has one 18-inch HDPE pipe that discharges to Poeling Lake with an invert of 434.5 feet on the upstream end. The invert elevation at the downstream end is 430 feet. These invert elevations were obtained from the plans provided.

The Bottom Ash Pond had an original outfall structure that was comprised of a large diameter galvanized corrugated steel skimmer that is perforated or overlaps to allow water to flow into a concrete pit. Within the pit, an emergency gate isolation system can be used to control flow. A 30-inch

concrete pipe discharges water from the concrete pit to Poeling Lake. Downstream invert elevation of the pipe is 422 feet.

2.5 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

A critical infrastructure inventory survey was not provided to Dewberry for review.

Based on available aerial images, however, Clark Bridge, which conveys 4 lanes of traffic on Route 67 over the Mississippi River, is located approximately 7 miles downstream of the Sioux Power Station. Please see Appendix A - Doc 1 for more information.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

Ameren Missouri provided copies of five internal reports, three weekly (routine) reports for the Fly Ash Pond and two annual reports.

Three weekly reports:

- Sioux Fly Ash Pond Weekly Inspection Check Sheet, dated 08/27/10.
- Sioux Fly Ash Pond Weekly Inspection Check Sheet, dated 09/03/10.
- Sioux Fly Ash Pond Weekly Inspection Check Sheet, dated 09/10/10.

Two annual reports:

- 2009 Annual Inspection Checklist - Email from Matthew K. Frerking, AmerenUE, with attached Fly Ash Pond Inspection Checklist, dated 1/15/2009.
- 2008 Annual Inspection Checklist - Email from Gene A. Campbell, AmerenUE, with attached Fly Ash Pond Inspection Checklist, dated 12/15/2009.

Both annual reports concluded that the ash ponds are in satisfactory conditions and identified several ongoing or short-term maintenance items, including:

- Clearing woody vegetation
- Placing rip-rap on eroded areas
- Removing rocks that are blocking outfall pipe
- Conducting video inspections
- Installing new staff gauges in the Fly Ash and Bottom Ash ponds.

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS.

Both the Fly Ash Pond Dam and Bottom Ash Pond Dam have dam heights less than 35 feet, therefore neither dam is regulated by the State of Missouri Department of Natural Resources.

Discharges from the impoundments are regulated by the State of Missouri Department of Natural Resources and they were issued a National Pollutant Discharge Elimination System Permit, Permit No. MO-0000353, on April 16, 2004.

That permit expired on April 15, 2009. Information regarding the pursuit or receipt of permit renewal was not provided.

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance problems with the embankment over the last 10 years.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Fly Ash Pond was constructed in the 1990's and the Bottom Ash Pond was constructed in the 1960's.

4.1.2 Significant Changes/Modifications in Design since Original Construction

No information was provided indicating that any significant changes/modifications in design were made since original construction. Dewberry's visual assessment during the field visit did not include any observations of prior releases, failures, or patchwork on either dam.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No information was provided indicating that any significant changes/modifications in design were made since original construction. Dewberry's visual assessment during the field visit did not include any observations of prior releases, failures, or patchwork on either dam.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Fly Ash Pond receives precipitation and fly ash slurry water. The Fly Ash Pond is regulated by one 18-inch HDPE pipe that outfalls to Poeling Lake. Flow through this pipe and the pool elevation of the pond are regulated by two motor operated butterfly valves. These valves are remotely operated. A staff gage is installed in the Fly Ash Pond to provide normal pool elevation levels to an observer.

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Bottom Ash Pond receives collected stormwater from the combined drain sump (CDS) via four pumps. There are two pumps driven by 200-horsepower pump motors and two pumps driven by 60-horsepower pump motors. These pumps have the combined total capacity to pump an estimated 46-cubic-feet-per-second. The

Bottom Ash Pond also receives flow from sluice water which is used to transport coal combustion ash. In addition, it receives treated wastewater via the CDS, but this volume is minimal. Water is discharged by a 30-inch concrete pipe to Poeling Lake.

4.2.2 Significant Changes in Operational Procedures and Original Startup

No documents were provided to indicate any operational procedures have changed for the Fly Ash Pond. To address sedimentation and lack of positive drainage in the Bottom Ash Pond, Ameren Missouri installed a 24-inch pipe that collects and distributes surface water of the pond directly to the concrete pit outfall area, bypassing a large diameter galvanized corrugated steel skimmer. The 24-inch pipe is buoyed to keep it near the surface and anchored to maintain its alignment. An emergency isolation gate system was installed to the Bottom Ash Pond overflow structure for flow control.

4.2.3 Current Operational Procedures

Current operational procedures, including maintenance and emergency action response actions, are outlined in the "AmerenUE Program DSP 003, Dam Safety Program for AmerenUE Non-Hydroelectric Facilities", dated September 4, 2009.

4.2.4 Other Notable Events since Original Startup

No additional information was provided to Dewberry of other notable events impacting the operation of the two ponds or their embankments.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Jeffrey Crabtree, P.E., and James Filson, P.E., performed a site visit on Thursday, September 30, 2010 in company with the participants.

The site visit began at 9:00 AM. According to National Weather Service data, the weather was sunny with ambient air temperatures measuring 70° F. Photographs were taken of conditions observed. Refer to photographs in Appendix B and the Dam Inspection Checklist in Appendix C for additional visual information. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit.

The overall assessment of the dam was that it was in satisfactory condition and no significant problems were noted.

5.2 FLY ASH POND

5.2.1 Embankment Crest

The crest of the embankment had no signs of significant depressions, tension cracks, or other indications of settlement or shear failure. Figure 5.2.1-1 shows the crest along its western boundary. The railroad and access road to the plant form the embankment. In this area the embankment is quite wide, approximately 75 feet in width.

Figure 5.2.1-1: Photograph of Fly Ash Embankment, View to the South

The southern embankment crest is much narrower in width, approximately 30 feet, than the western crest, and also contains a railroad bed that is used by the plant operators two to three times during the week (Fig. 5.2.1-2).

Figure 5.2.1-2: Photograph of Fly Ash Embankment, View to the East

5.2.2 Upstream/Inside Slope

According to the Reitz & Jens, Inc. 2007 Phase I Sioux Plant Report provided by Ameren Missouri, the Fly Ash Pond was lined with a 60-mils thick HDPE liner in 1993. There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope stability problems. Figure 5.2.2-1 shows a representative section of the upstream/inside slope of the embankment.

Figure 5.2.2-1: Photograph of Upstream/Inside Slope of Fly Ash Pond, View Looking East

5.2.3 Downstream/Outside Slope and Toe

Areas of surface runoff erosion were observed on the downstream/outside slope of the Fly Ash embankment in parts. Rip-rap has been added to those areas to minimize future erosion and they are monitored for stability on a weekly basis. Figure 5.2.3-1 shows one example of the eroded areas at the time of the site visit, near the northwest corner of the embankment. The area shown in Figure 5.2.3-1 has been regarded and repaired, in January 2011, utilizing geotextile and riprap for the the entire length of the face of the embankment slope to minimize future erosion.

Figure 5.2.3-1: Photograph of Fly Ash Dam Downstream/Outside Slope, View to the South

5.2.4 Abutments and Groin Areas

The Fly Ash Pond embankment has no abutments or groin areas.

5.3 BOTTOM ASH POND

5.3.1 Embankment Crest

The crest of the embankment had no signs of significant depressions, tension cracks, or other indications of settlement or failure. There were some areas of erosion which have been overlain with rip-rap to enhance stability. One area of the embankment had obvious signs of ash along the inside slope and crest (Fig. 5.3.1-1).

Figure 5.3.1-1: Photograph of Bottom Ash Pond with ash on crest, View Looking West

5.3.2 Upstream/Inside Slope

The upstream/inside slope is vegetated with various scrub/shrub species and tall grasses and wildflowers. There were no observed scarps, sloughs, bulging, cracks, depressions, or other signs of slope instability. Rip-rap had been placed along the interior slopes of the northern and northwestern portions of the embankment to enhance stability.

Figure 5.3.2-1: Photograph of Bottom Ash Pond Upstream/Inside Slope, View Looking West

Figure 5.3.2-2: Photograph of Bottom Ash Pond Upstream/Inside Slope, View looking North

5.3.3 Downstream/Outside Slope and Toe

The downstream/outside slope and toe of the Bottom Ash Pond embankment are covered in various plant species; along the slope are various scrub/shrub plant species and tall grasses and wildflowers, while some larger trees are located at the toe of the slope.

Figure 5.3.3-1: Photograph of Bottom Ash Pond Downstream/Outside Embankment, View Looking North

A small seep was observed (Fig. 5.3.3-2) in the northeastern corner of the pond embankment, approximately 75' from the toe of the embankment. The situation is monitored weekly by Ameren Missouri personnel.

Ameren Missouri has initiated a project to install an inverted filter along the seepage area, and is projected to be implemented in 2011.

Figure 5.3.3-2: Photograph of clearwater seep emerging 75' from toe of embankment.

5.3.4 Abutments and Groin Areas

The Bottom Ash Pond embankment has no abutments or groin areas.

5.4 OUTLET STRUCTURES

5.4.1 Overflow Structure

The Bottom Ash Pond has a concrete pit where pond water drains before discharging via a 30-inch concrete pipe. The outfall structure comprises of a 24-inch HPDE pipe with a suction bell below the water surface and a large diameter galvanized corrugated steel skimmer to allow water to flow into the concrete pit (Fig 5.4.1-1). A portion of the corrugated steel skimmer was removed to allow additional flow to enter the structure.

Figure 5.4.1-1: Emergency isolation gate system for flow control for the Bottom Ash Pond.

The Fly Ash Pond outfall is comprised of one 18-inch HDPE pipe which is upturned to an elevation of 434.5 feet on the upstream end.

5.4.2 Outlet Conduit

The Fly Ash Pond outfalls to Poeling Lake via an 18" HDPE pipe. The outlet conduit appeared to be in good shape and operating normally with no signs of clogging. Water discharging from the pipe appeared to be clear.

Figure 5.4.2-1: Photograph of Fly Ash Pond outfall (18" HDPE pipe) and stilling basin, Looking West

The 30-inch concrete pipe outlet conduit for the Bottom Ash Pond appeared to be in good shape and operating normally with no signs of clogging. Water discharging from the pipe appeared to be clear.

Figure 5.4.2-2: Photograph of Bottom Ash Pond outfall, Looking West

5.4.3 Emergency Spillway

There is no emergency spillway for the Fly Ash Pond. The emergency isolation gate is located within the overflow structure in the Bottom Ash Pond. The emergency isolation gate acts as an emergency weir to allow flow to be routed through the outlet pipe to prevent overtopping of the perimeter embankment.

5.4.4 Low Level Outlet

No low level outlet is present for either the Fly Ash Pond or Bottom Ash Pond.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation on Flood of Record was provided. Consulting the FEMA Flood Insurance Rate Map for St. Charles County, Missouri and Incorporated Areas (Panel 150 of 525), Map Number 29183C0150 E, Revised August 2, 1996, the flood elevation for the 100-year event is approximately 438.5 feet. Both ponds, according to the FIRM, are located above the 100-year floodplain. The crest elevation for the Fly Ash Pond ranges between 441.5 and 446.4 feet, giving a minimum of 3 feet of clearance outside the pond during the 100-year flood event. The crest elevation for the Bottom Ash Pond ranges between 443 and 445 feet, giving a minimum of 4.5 feet of clearance outside the pond during the 100-year flood event.

6.1.2 Inflow Design Flood

Ameren Missouri contracted Reitz & Jens, Inc. to conduct a hydrologic/ hydraulic study for the ponds, which was issued on August 27, 2007, to analyze the capacity of the Fly Ash Pond and Bottom Ash Pond to store water from the design storm event. The design storm was a 100-year (1 percent annual exceedance probability), 24 hour event with an estimated depth of 7.0 inches. The report concluded that there is sufficient capacity to store water from this event if normal pool elevations of 440 feet in the Fly Ash Pond and 440.5 feet in the Bottom Ash Pond are maintained. The Bottom Ash Pond receives the site's stormwater runoff as well bottom ash slurry water. The Fly Ash Pond does not receive site stormwater.

6.1.3 Spillway Rating

Neither the Fly Ash nor the Bottom Ash Pond have emergency spillways.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided to Dewberry.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Overall, the supporting technical documentation is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Based on the information provided, both the Fly Ash Pond and Bottom Ash Pond are designed to handle the 100-year flood event.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

No stability analyses were provided for the original design and construction of the perimeter levee at the time of the site visit. Subsequently, an Ash Pond Dam Stability Analysis, conducted by Reitz & Jens, Inc., in November 2010 for the Fly Ash Pond and Bottom Ash Pond dams has been provided by Ameren Missouri.

7.1.2 Design Parameters and Dam Materials

Fly Ash Pond - In the 2010 Ash Pond Dam Stability Analysis borings of the embankment consists of alternating layers of sand, silt, and clay (Reitz & Jens, Inc., 2010). The embankment soils have a computed friction angle of 25° to 28°. Foundation soils consist of firm to stiff clay soil and underlying silty sand and sand. The foundation soils have a computed friction angle of 23° to 35°.

Bottom Ash Pond - In the 2010 Ash Pond Dam Stability Analysis borings of the embankment consists of very soft to stiff clay, silt and sand layers (Reitz & Jens, Inc., 2010). The embankment soils have a computed friction angle of 26°. Foundation soils consist of high plastic clay or silty clay. The foundation soils have a computed friction angle of 23.5°. Underlying the clay is sand and silty sand. The computed friction angle ranges from 30° to 35°.

7.1.3 Uplift and/or Phreatic Surface Assumptions

Pheratic surface assumptions area taken from the November 2010 Ash Pond Dam Stability Analysis. The downstream sides of the CCW pond embankments were analyzed for steady seepage and seismic seepage loading conditions at full and maximum pond capacity. Piezometer readings for the Fly Ash Pond and the Bottom Ash Pond, from the November 2010 Ash Pond Dam Stability Analysis, show the groundwater elevation to be above the downstream toe elevation. Ash Pond dam is lined. Therefore, a pheratic line does not occur through the embankment. Bottom Ash Pond is not lined and the pheratic line extends through the embankment from the normal pool elevation to the downstream toe of the embankment and then follows the natural ground to the base.

7.1.4 Factors of Safety and Base Stresses

A slope stability analysis was conducted and results presented in the November 2010 Ash Pond Dam Stability Analysis conducted by Reitz & Jens, Inc.

The seismic slope stability analysis was performed using a horizontal acceleration coefficient. This coefficient represents the fraction of the gravitational acceleration applied horizontally to the soil mass directed away from the slope to approximate the lateral forces on the dike mass that occur during an earthquake. Seismic stability analysis was performed for the downstream slope only. A horizontal acceleration of 0.05g or 0.25 of the probable maximum acceleration was added to the steady state seepage model.

The results, summarized in Table 7.1, show the Fly Ash Pond meets the MDNR and the Corps of Engineers minimum required factor of safety for steady seepage loading and seismic loading (Reitz & Jens, Inc., 2010). However, the Bottom Ash Pond does not meet the minimum required Factor of Safety, 1.5, for the full reservoir steady seepage loading condition; while the Factor of Safety results for maximum reservoir steady seepage loading and seismic loading conditions are greater than the minimum required factors of safety (Reitz&Jens, Inc., 2010).

Table 7.1: Factor of Safety (Reitz & Jens, Inc., November 16, 2010)

Load Case	Required Factor of Safety	Fly Ash Pond	Bottom Ash Pond
Full Reservoir, Steady Seepage	1.5	1.9	1.4*
Maximum Reservoir, Steady Seepage	1.3	1.8	1.3
Earthquake, Steady Seepage, Full Reservoir	1.0	1.6	1.2

* See Table 7.2 below for updated Factor of Safety results

The 2010 Reitz & Jens, Inc Stability Analysis discusses the fact that the Bottom Ash Pond Factor of Safety does not meet the required 1.5 per MDNR and the Corps of Engineers.

"When shallow failure surfaces are considered the factor of safety degrades for all load cases, especially along the west side of the bottom ash pond" (page 6 of the 2010 Reitz & Jens, Inc. Report). On page 8 of the report, "The slope stability analysis considered critical surfaces which would significantly impact the performance of the dam … … Although shallow failures may not immediately impact the performance of the dam, if left unchecked these problems can propagate …".

Ameren has been monitoring this seepage area and conducts weekly inspections documenting their findings. In addition, Ameren planned to implement a project to install an inverted filter along the seepage area in the third/fourth quarter of 2011. This project will improve the factor of safety for the Bottom Ash Pond above the requirement of 1.5. Table 7.2 shows the existing and improved factors of safety for the Bottom Ash Pond.

Table 7.2: Updated Factor of Safety (Reitz & Jens, Inc., July 29, 2011)

	Factor of Safety, Full reservoir, Steady Seepage	
Cross-section	**Prior SEP 2011 Long-term**	**SEP 2011, Long-term**
1 (Northwest)	1.40	1.64
North (Northeast)	1.32	1.52
2 (West)	1.51	N/A

The Bottom Ash Pond factor of safety recommendations and computations from Reitz & Jens, Inc. are shown in Document 7 in Appendix A. Figure 7.1.4-1 shows remediation activities that addressed the safety factor issues. The additional of an inverted filter and rip-rap along the outside of the embankment is part of the proposed safety factor improvement project.

Figure 7.1.4-1: Bottom Ash Pond embankment safety factor improvements underway.

7.1.5 Liquefaction Potential

The seismic analyses provide sufficient soils characteristics to determine that the soils underlying the ponds are not susceptible to liquefaction.

7.1.6 Critical Geological Conditions

No detailed geologic information was provided to Dewberry; therefore we are not able to assess critical geological conditions.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability under static loading and seismic loading conditions of the perimeter levee embankments at the Fly Ash Pond and at the Bottom Ash Pond meet minimum factors of safety, based on the November 2010 Reitz & Jens, Inc Ash Pond Dam Stability Analysis, and the July 2011 letter from Reitz & Jens to Ameren Missouri (see Appendix A – Docs 6 and 7).

Based on the above the Fly Ash pond receives a **SATISFACTORY** rating and the Bottom Ash pond receives a **SATISFACTORY** rating.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The Fly Ash pond is operated for storage of fly ash deposits. The Bottom Ash Pond is operated for the storage of bottom ash deposits as well receiving and treating the Sioux Plant's site stormwater. Both ponds have gravity discharges of clarified water to Poeling Lake.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Ameren Missouri developed and currently maintains both a dam safety program and an emergency procedure protocol. Guidelines and regulations for each can be found in the Dam Safety Program for Ameren UE Non-Hydroelectric Facilities, dated September 4, 2009, and the Emergency Plant Dam Failure/Loss of Integrity Procedures, dated December 5, 2002. Ameren Missouri's dam safety program includes, but is not limited to:

- Defining the policies and expectations of the dam safety program,
- Duties and responsibilities of dam operating personnel,
- Details regarding dam safety training requirements for operating personnel, and
- Weekly, annual and special event inspection requirements specific to the Sioux Station's Fly Ash and Bottom Ash pond dams.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on the assessments of this report, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Based on the example inspection documents provided by Ameren Missouri, as well as the field inspection performed by Dewberry staff, there are no significant maintenance issues that jeopardize the integrity of the Fly Ash Pond dam or the Bottom Ash Pond dam. Although maintenance procedures appear to be adequate, several maintenance recommendations are offered:

- Areas where erosion has occurred on the dam should be rehabilitated.
- Tree encroachment along inside or outside slopes of either pond embankment should be minimized. Periodic maintenance of vegetation and tree growth is necessary, including at the toe of the embankment.
- Minor seepage in any areas along the embankment should be closely monitored.

Based on the assessments of this report, maintenance procedures appear to be adequate.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

According to Ameren Missouri's Dam Safety Program for Non-Hydroelectric Dams, four types of dam safety inspections are performed at the Sioux Station. These consist of routine inspections, annual inspections, special inspections, and unannounced inspections. For the Sioux Plant, routine inspections are performed weekly, annual inspections are performed annually, and special inspections are performed as needed. All inspections are documented on standardized Ameren Missouri inspection forms and checklists.

9.2 INSTRUMENTATION MONITORING

9.2.1 Instrumentation Plan

There is no dam performance monitoring instrumentation in place in the impounding levee embankment. Staff gauges have been installed to measure the water surface elevation.

9.2.2 Instrumentation Monitoring Results

There are no dam performance monitoring results.

9.2.3 Dam Performance Data Evaluation

This is not applicable since there are no dam performance data to evaluate.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

The inspection program is generally adequate based on field observations and the data reviewed by Dewberry. However, internal inspections of the outlet structures with a remote camera or by personnel using confined-space procedures should be conducted on a frequency of at least once every 5 years.

9.3.2 Adequacy of Instrumentation Monitoring Program

There is no dam performance monitoring instrumentation in place. No problem or suspect condition, such as excessive settlement, seepage, shear failure, or displacement was observed in the field that might be reason for installation of instrumentation. In the absence of stability problems or seepage issues, there is no need for performance monitoring instrumentation at this time.

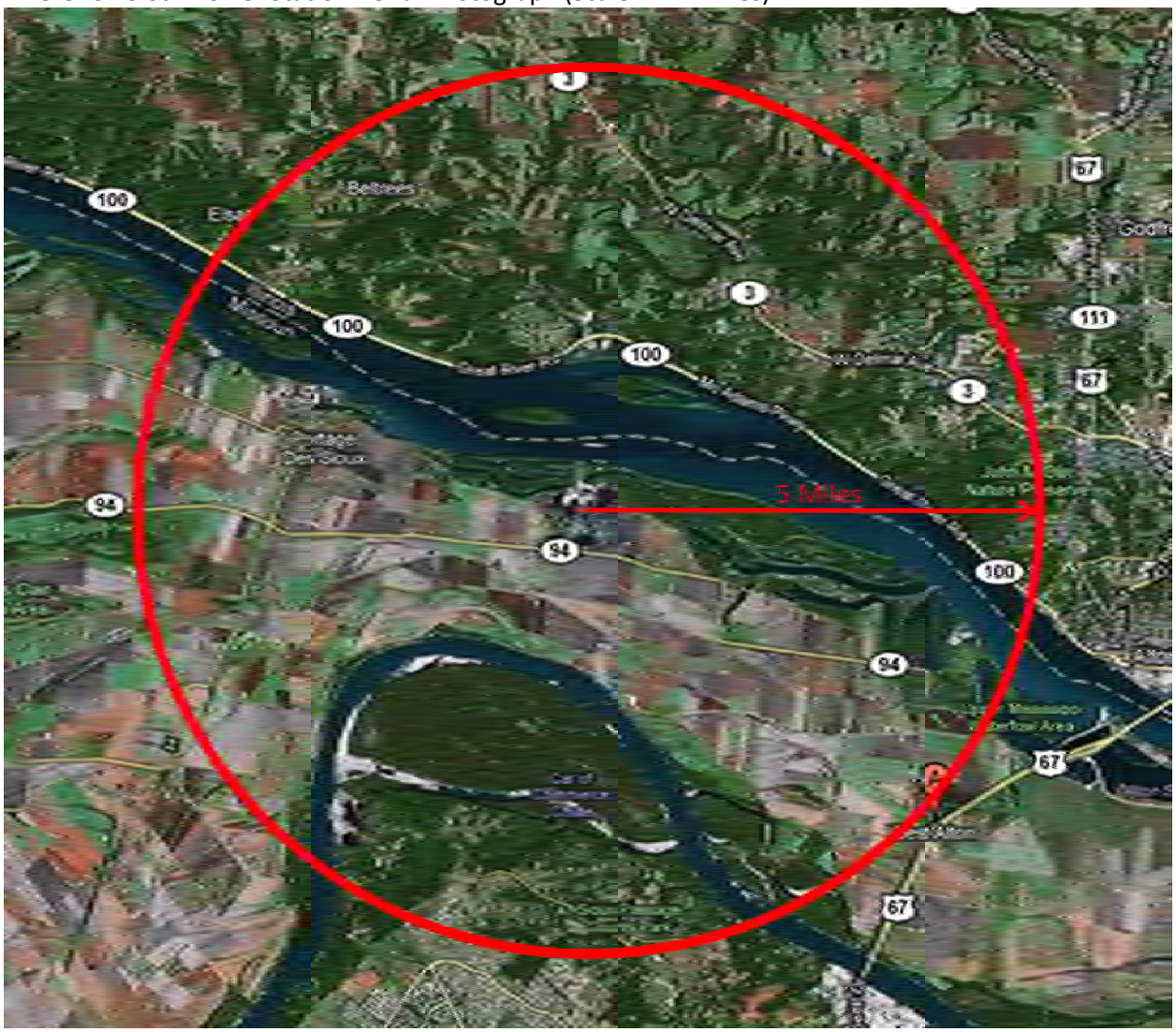
APPENDIX A

Document 1

Site Map & Aerial Photograph (with 5-mile ring)

AmerenUE Sioux Power Station Site Map (Scale: 1”=2 mi)

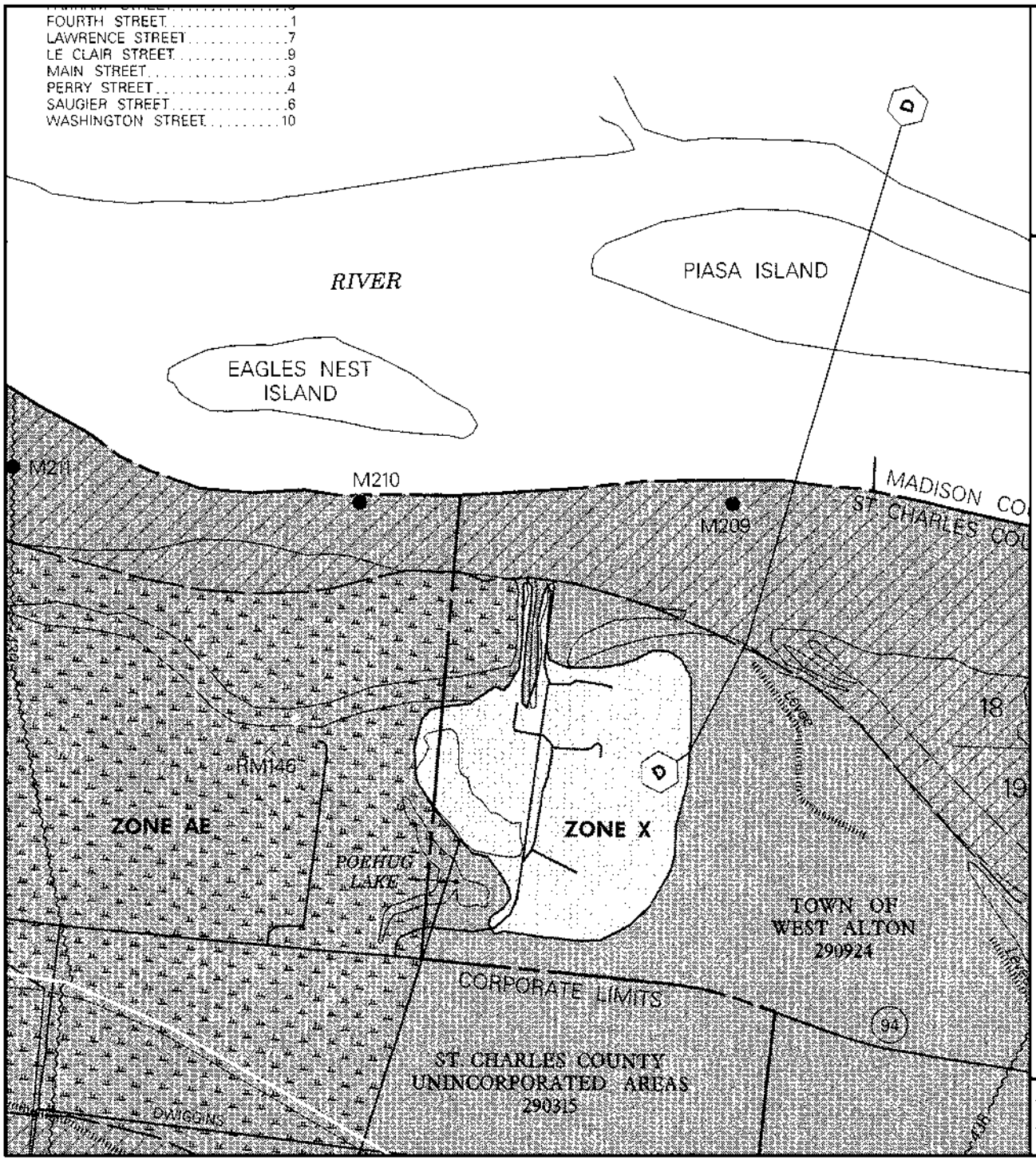
AmerenUE Sioux Power Station Aerial Photograph (Scale: 1”=2 miles)



APPENDIX A

Document 2

FEMA FIRMette



APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

ST. CHARLES COUNTY, MISSOURI AND INCORPORATED AREAS

PANEL 150 OF 525

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PORTAGE DES SIOUX, CITY OF	290897	0150	C
ST. CHARLES COUNTY: UNINCORPORATED AREAS	290315	0150	E
WEST ALTON, TOWN OF	290924	0150	E

MAP NUMBER 29183C0150 E

MAP REVISED: AUGUST 2, 1996

Federal Emergency Management Agency

APPENDIX A

Document 3

Sioux Power Stations Plans

REVISIONS

FIRST ISSUE

NOTE: PLAN DETAIL (AUTO PLOT) FROM PHOTOGRAMMETRIC DIGITAL DATA.
CONTOURS WERE COMPILED AS DIGITAL STRING DATA DIRECTLY FROM THE STEREO PLOTTER (STRING FORMED BY X, Y, Z COORDINATES).

LEGEND

RAILROAD		MANHOLE	
PAVED ROAD		CATCH BASIN	
UNPAVED ROAD		LOCATED OBJECT	
TRAIL		SINGLE TREE	
SIDEWALK		TREE LINE	
BUILDING		STREAM	
FOUNDATION		INDEX CONTOUR	
FENCE		DEPRESSION CONTOUR	
WALL		APPROXIMATE CONTOUR	
SIGN		SPOT ELEVATION	425.6
POLE			

TOPOGRAPHIC MAP

PREPARED FOR:
UNION ELECTRIC

PREPARED BY:
WALKER & ASSOCIATES
1650 HEADLAND DR.
FENTON, MO. 63026

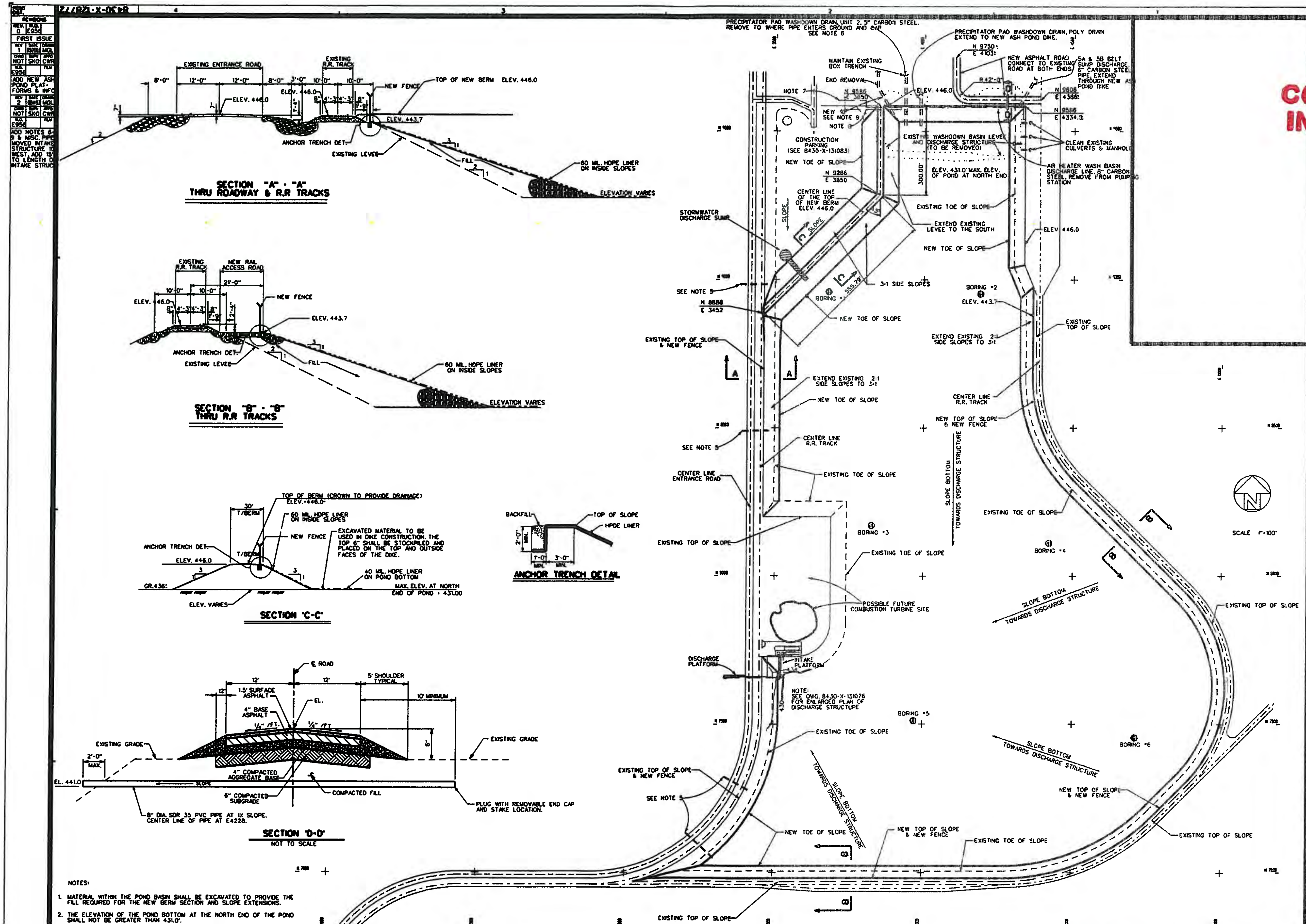
SCALE: 1"=100' CONTOUR INT. 1' PHOTOS FLOWN 12-1-
CONTROL DATUM: HOR. ASSUMED VER. MSL
DASHED CONTOURS MAYBE UNRELIABLE

PROPERTY - TOPOGRAPHIC MAP
ASH POND AREA
FROM AERIAL SURVEY 12-1-1992

001009 SIOUX PLANT 02010

UNION ELECTRIC COMPANY

8430-X-128771 0



NOTES:

1. MATERIAL WITHIN THE POND BASIN SHALL BE EXCAVATED TO PROVIDE THE FILL REQUIRED FOR THE NEW BERM SECTION AND SLOPE EXTENSIONS.
2. THE ELEVATION OF THE POND BOTTOM AT THE NORTH END OF THE POND SHALL NOT BE GREATER THAN 431.0'.
3. THE ELEVATION OF THE POND BOTTOM AT THE SOUTH END OF THE POND SHALL NOT BE LESS THAN 422.0'.
4. THE POND BOTTOM SHALL BE GRADED TO A CONSTANT UNIFORM SLOPE STARTING FROM THE NORTH END AND EXTENDING SOUTH TO THE DISCHARGE STRUCTURE WITH NO MOUNDS OR DEPRESSED AREAS.
5. APPROXIMATE LOCATION OF EXISTING CULVERTS. THEY ARE TO BE PLUGGED WITH CONCRETE AND ABANDONED IN PLACE. ANY EXISTING CULVERTS NOT SHOWN ON DRAWING SHALL ALSO BE PLUGGED WITH CONCRETE AND ABANDONED IN PLACE (IN THE AREA OF THE NEW ASH POND).
6. PRECIPITATOR PAD WASHDOWN DRAIN, UNIT 1, 5" CARBON STEEL. EXTEND PIPE THROUGH NEW ASH POND DIKE. (EXTEND UNIT 1 LINE INTO POND).
7. END REMOVAL OF AIR HEATER WASH BASIN DISCHARGE LINE AND CAP LINE.
8. CAUSTIC INJECTION LINE, ¾" CARBON STEEL, REMOVE FROM AIR HEATER WASH BASIN DISCHARGE LINE TO POINT INDICATED BY NOTE 7 AND CAP LINE.
9. REMOVE EXISTING 10" SHOT PIT DISCHARGE LINE FROM WHERE THE LINE GOES UNDERGROUND AT THE AIR HEATER TO THE NEW ASH POND. INSTALL NEW 10" NASPIPE FROM END OF REMOVALS AND EXTEND INTO NEW ASH POND. INSTALL 30° NASPIPE ELBOW AND OLD PIPE CONNECTION TO REDIRECT FLOW. NEW PIPING SHALL BE BURIED. BURIED PIPING SHALL BE SLEEVED BY A 16" CARBON STEEL SCH 40 PIPE. RESTORE ASPHALT PAVING.

FOR EXISTING GROUND CONDITIONS SEE DRAWING 8430-X-128771

PROPERTY - PLAN
NEW ASH POND

SIOUX PLANT

P.O.O.
SKO
3-30-93
C.W. REZSONY
001009
02010
UNION ELECTRIC COMPANY
8430-X-128772
REV. 2

REVISIONS

REV. 0 W.O. E956

FIRST ISSUE

REV 1 MGL

NOT SKO CWR

W.O. J639

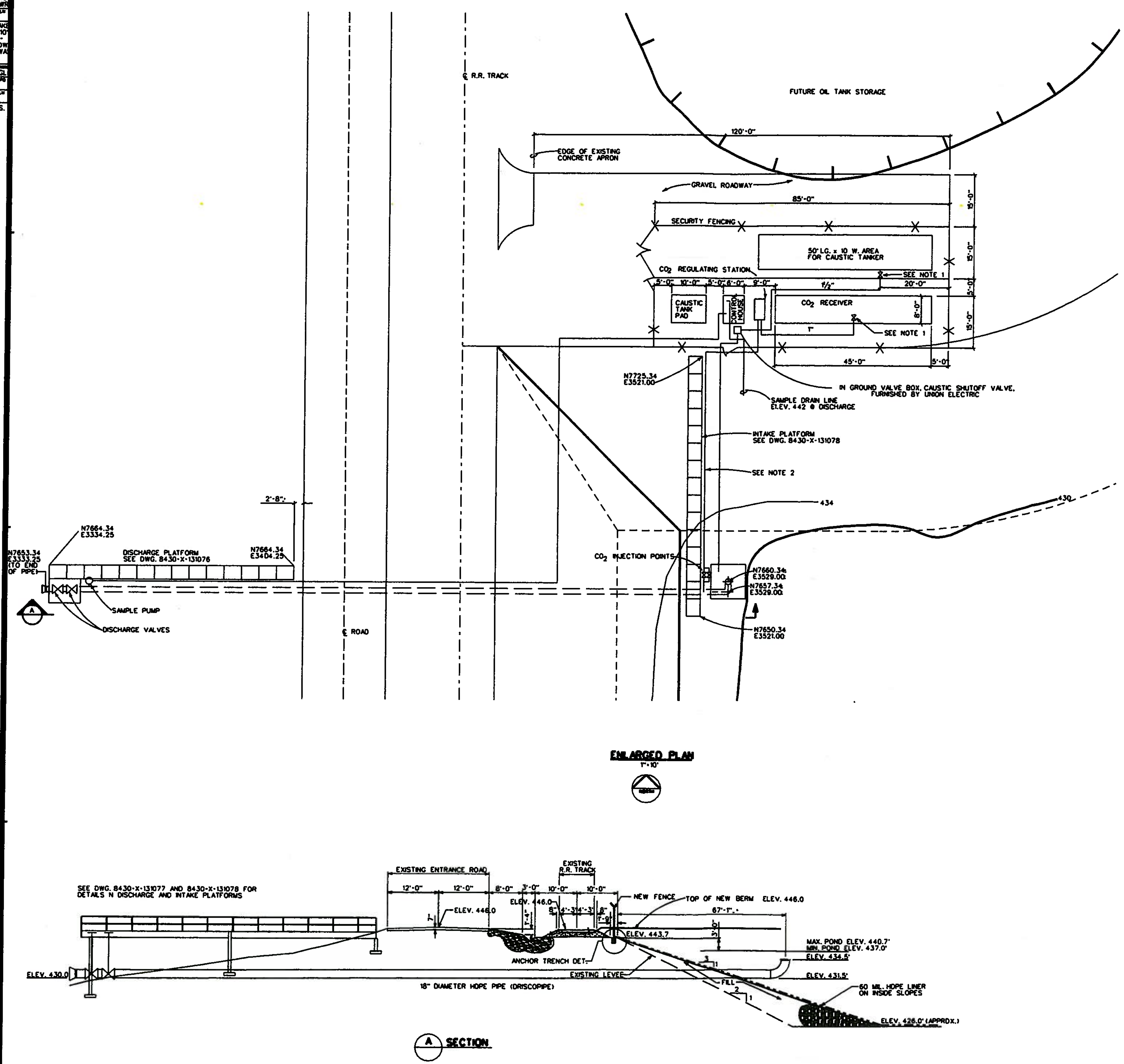
MOVED INTAKE PLATFORM 10' WEST. PLATFORM IS NOW 75' LONG (WAS 60' LONG)

REV 2 MGL

TG SKO

W.O. 6672

ADD. COORDS. & SLIP ON BCK. WTR. VLV.



NOTES:

1. PIPING IS BURIED 1'-0" BELOW GRADE. EXTEND PIPING ABOVE GRADE AND LOCATE BALL VALVE 1'-0" ABOVE GRADE. INSTALL PIPE NIPPLE AND CAP ON UPPER VALVE THREADED CONNECTION.
2. RUN CO2 AND CAUSTIC PIPING ON INTAKE PLATFORM AT GRATING ELEVATION. LOCATE BOTH CO2 ISOLATION VALVES FOR EASY ACCESS FROM PLATFORM. EXTEND CAUSTIC LINE TO EXTEND 1'-0" INTO 18" DISCHARGE PIPE INLET.

REFERENCE DRAWINGS:

8430-X-128771-----PROPERTY-TOPOGRAPHIC MAP (EXISTING GROUND CONDITIONS)
8430-X-128772-----PROPERTY-PLAN

DO NOT SCALE DRAWING!

REV. 0 SEALED BY

MIKE LOWRY

NOT CHKD.

STEVE OTT

PROPERTY - ENLARGED PLAN
NEW ASH POND
DISCHARGE STRUCTURE

001009 SIOUX PLANT 02010

UNION ELECTRIC COMPANY ST. LOUIS, MO.

8430-X-131076 REV. 2

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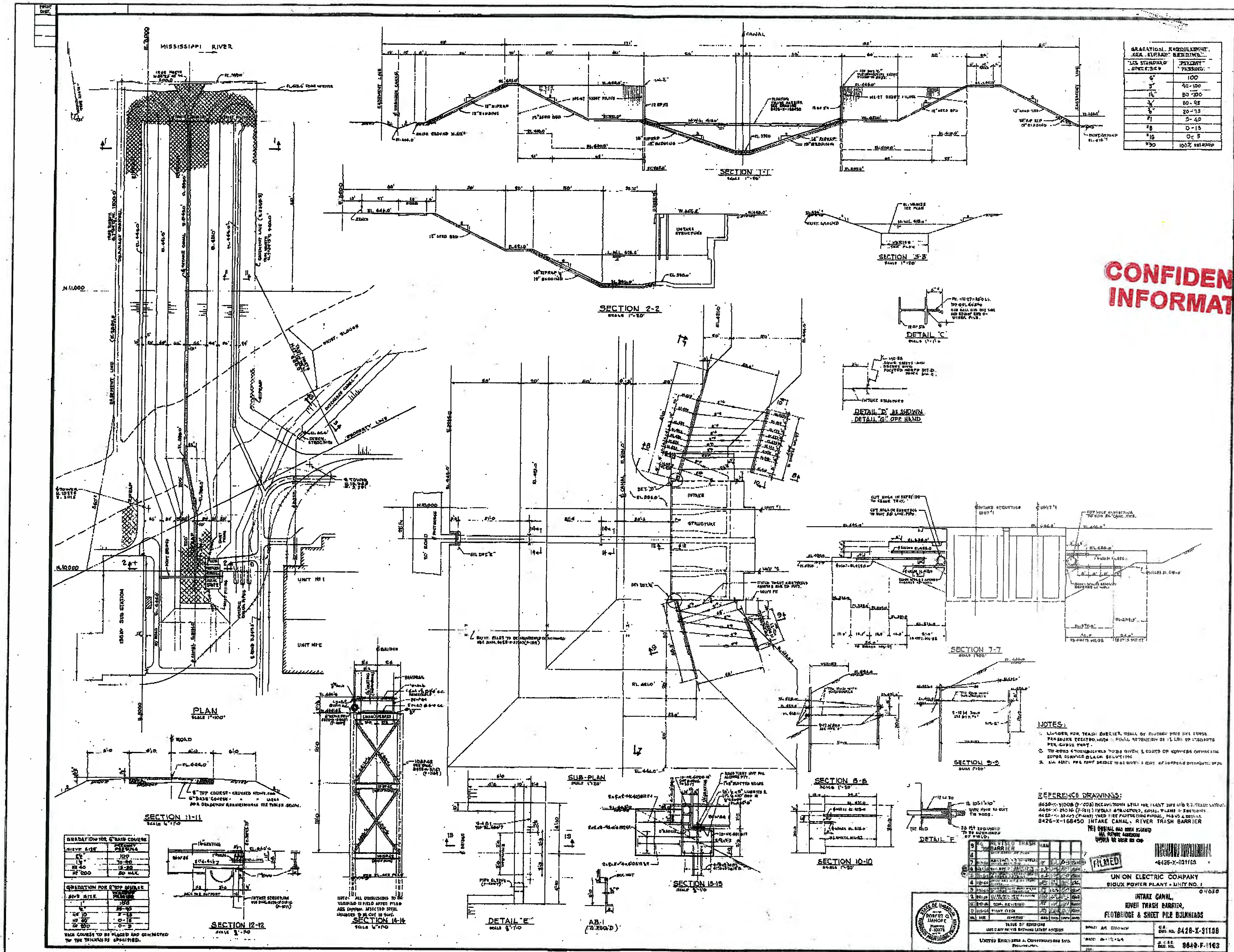
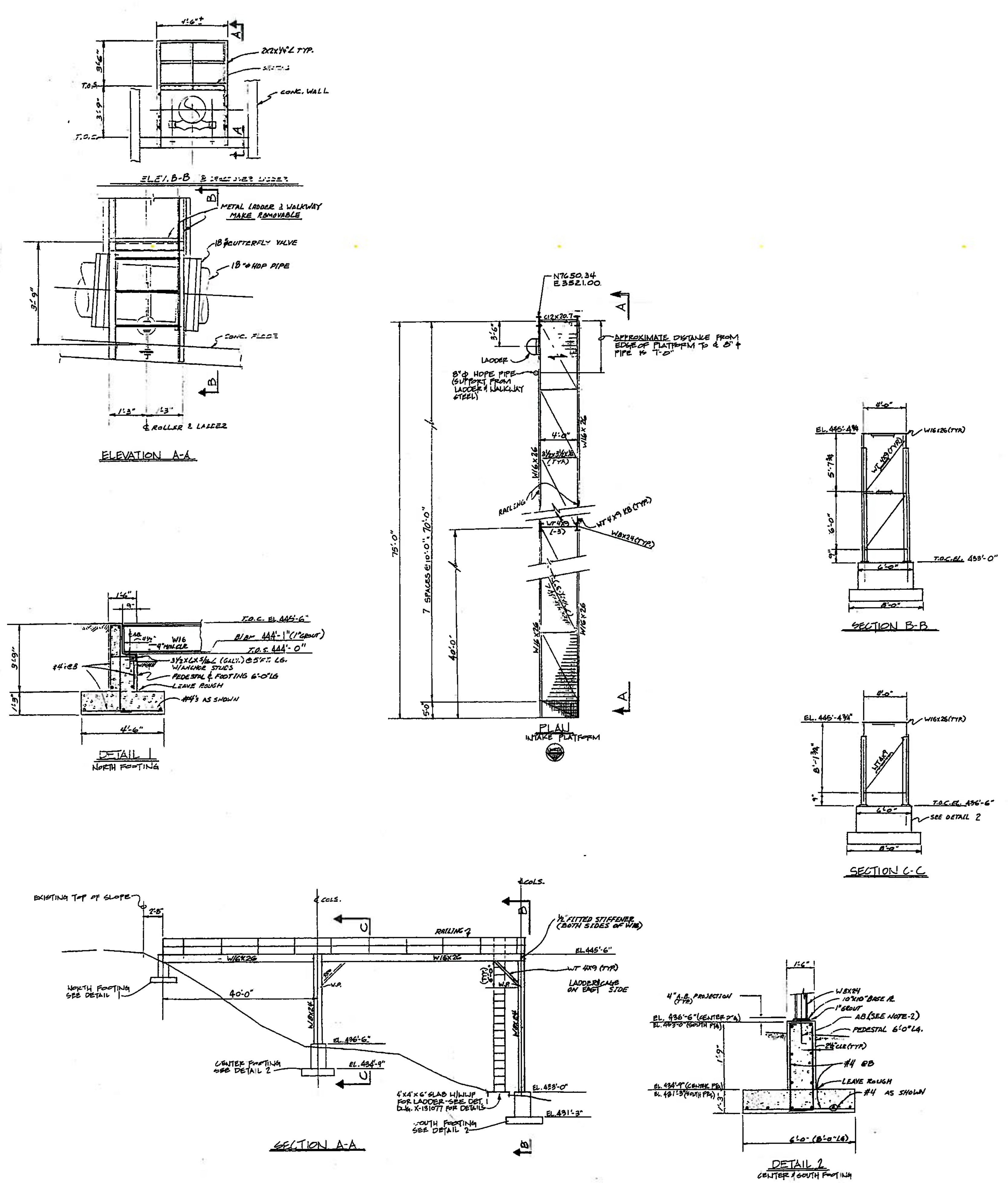


U.S. STANDARD SIEVE SIZE	PERCENT PASSING
6"	100
3"	90-100
1½"	80-100
¾"	60-95
⅜"	20-73
#4	5-40
#8	0-15
#16	0-5
#30	100% RETAINED

CONFIDENTIAL INFORMATION

P:\SIOUX\STR\31108.dgn 09/10/2010 9:45:58 AM



CONFIDENTIAL INFORMATION

NOTES:

1. THIS WORK TO BE DONE IN ACCORDANCE WITH U.E. SPEC. NO. EC-2779.
2. ELEVATIONS GIVEN FOR CONCRETE FOOTINGS ARE ESTIMATED AND SHOULD BE VERIFIED IN THE FIELD BEFORE ANY WORK BEGINS.

REFERENCE DRAWINGS:

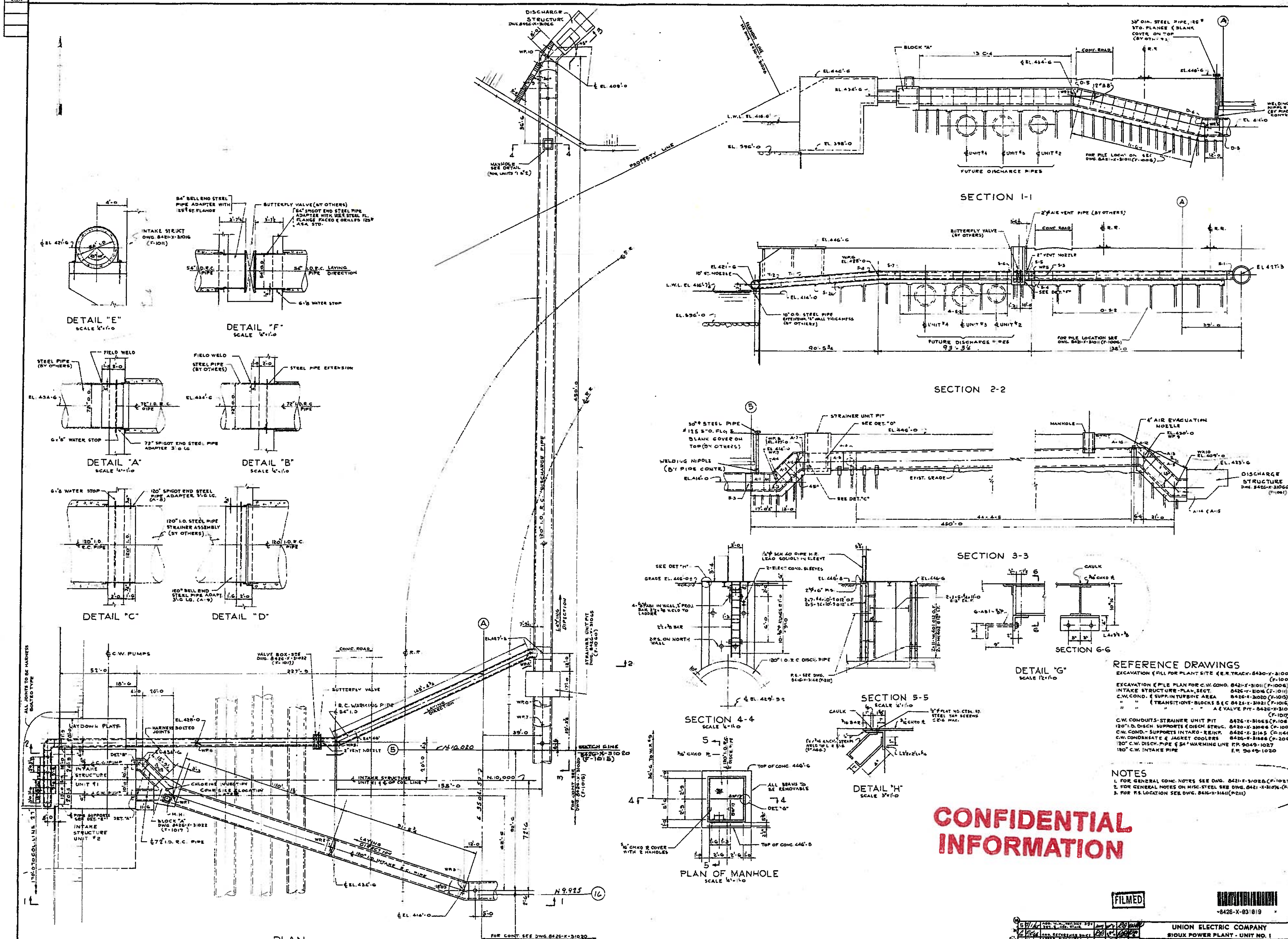
8430-X-128772 ---- PROPERTY PLAN

THIS DRAWING HAS NO SCALE

8430-X-131078

DRAWN: MIKE LOWRY	STRUCTURE-ASSEMBLY & DETAILS NEW ASH POND INTAKE STRUCTURE	
CHKD. NOT CHKD.		
SUPV. STEVE		
APPD. CARL REZBONYA	LOCATION	SIOUX PLANT
UNION ELECTRIC COMPANY ST. LOUIS, MO.	8430-X-131078	REV. 2

STATE OF MISSOURI — CARL W. REZBONYA — NUMBER E-18282 — REGISTERED PROFESSIONAL ENGINEER



CONFIDENTIAL INFORMATION

REFERENCE DRAWINGS

EXCAVATION & FILL FOR PLANT SITE & R.R. TRACK	8430-X-31008 (F-1008)
EXCAVATION & PILE PLAN FOR C.W. COND.	8421-X-31011 (F-1006)
INTAKE STRUCTURE-PLAN, SECT.	8426-X-31016 (F-1011)
C.W. COND. & SUPP. IN TURBINE AREA	8426-X-31020 (F-1015)
" " & TRANSITIONS-BLOCKS B & C	8426-X-31021 (F-1016)
" " " - " A & VALVE PIT	8426-X-31022 (F-1017)
C.W. CONDUITS-STRAINER UNIT PIT	8426-X-31065 (F-1060)
120" I.D. DISCH. SUPPORTS & DISCH. STRUC.	8420-X-31066 (F-1001)
C.W. COND.- SUPPORTS IN TARO-REINF.	8426-X-31145 (F-1140)
C.W. CONDENSATE & JACKET COOLERS	8426-X-31866 (F-2066)
120" C.W. DISCH. PIPE & 54" WARMING LINE	F.P. 9049-1027
120" C.W. INTAKE PIPE	F.P. 9049-1020

NOTES

1. FOR GENERAL CONC. NOTES SEE DWG. 8421-X-31028 (F-1023)
2. FOR GENERAL NOTES ON MISC. STEEL SEE DWG. 8421-X-31076 (F-1071)
3. FOR P.S. LOCATION SEE DWG. 8416-X-31411 (F-2111)

FILMED

8426-X-031019

NO.	DATE	DESCRIPTION
5	7/1/65	ADD. M.H., REV. [illegible]
4	[illegible]	ADD. REFERENCE DWGS.
3	[illegible]	ADDED [illegible] & EASEMENT LINE
2	[illegible]	REV. 54" PIPE [illegible] SUPP. SPACING, ADD. M.H.
1	[illegible]	ADDED STRAINER PIT & REV. 54" LINE
0	9/26/63	FIRST ISSUE

TABLE OF REVISIONS
USE ONLY PRINTS SHOWING LATEST REVISION

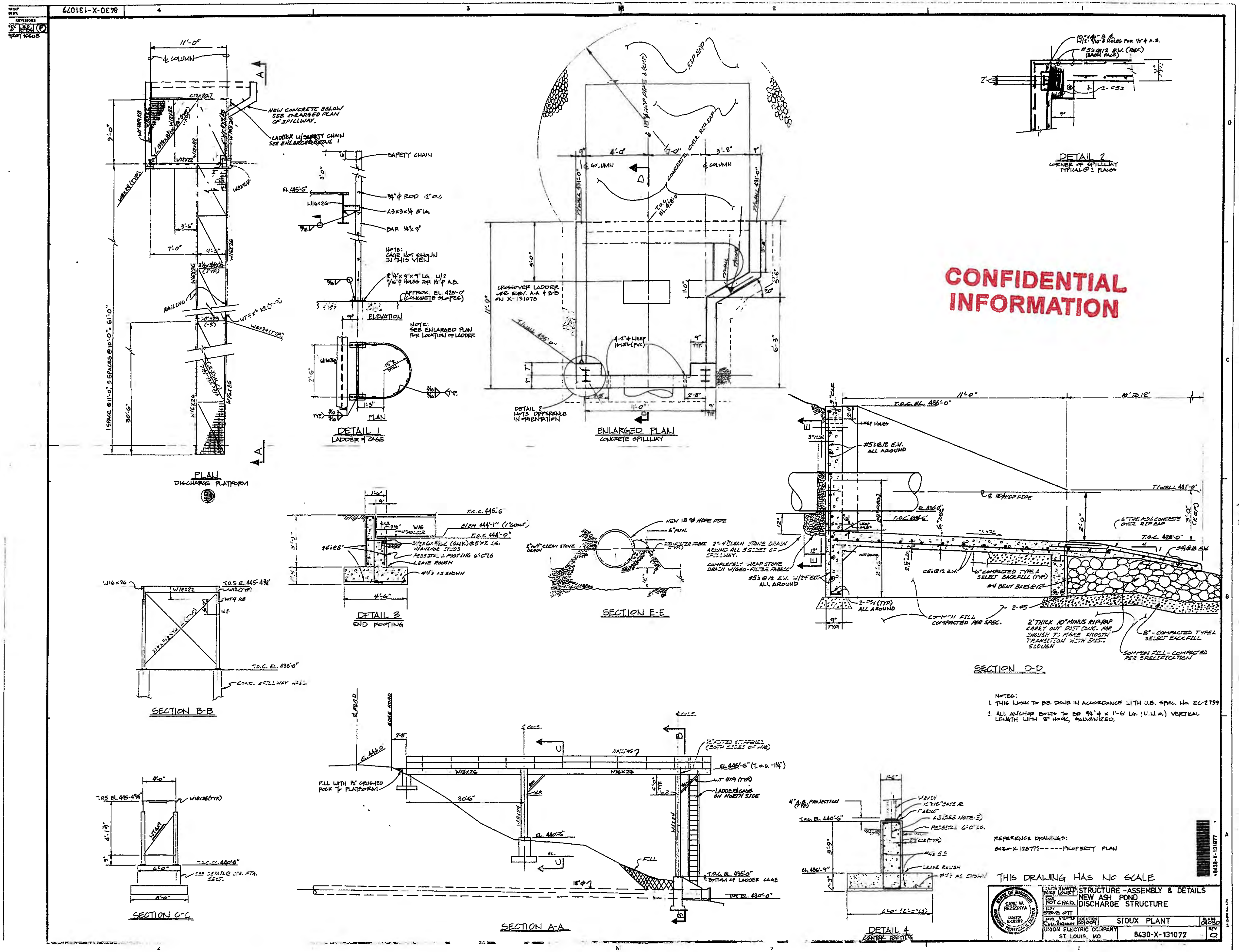
UNITED ENGINEERS & CONSTRUCTORS INC.
PHILADELPHIA

UNION ELECTRIC COMPANY
SIOUX POWER PLANT - UNIT NO. 1
05020

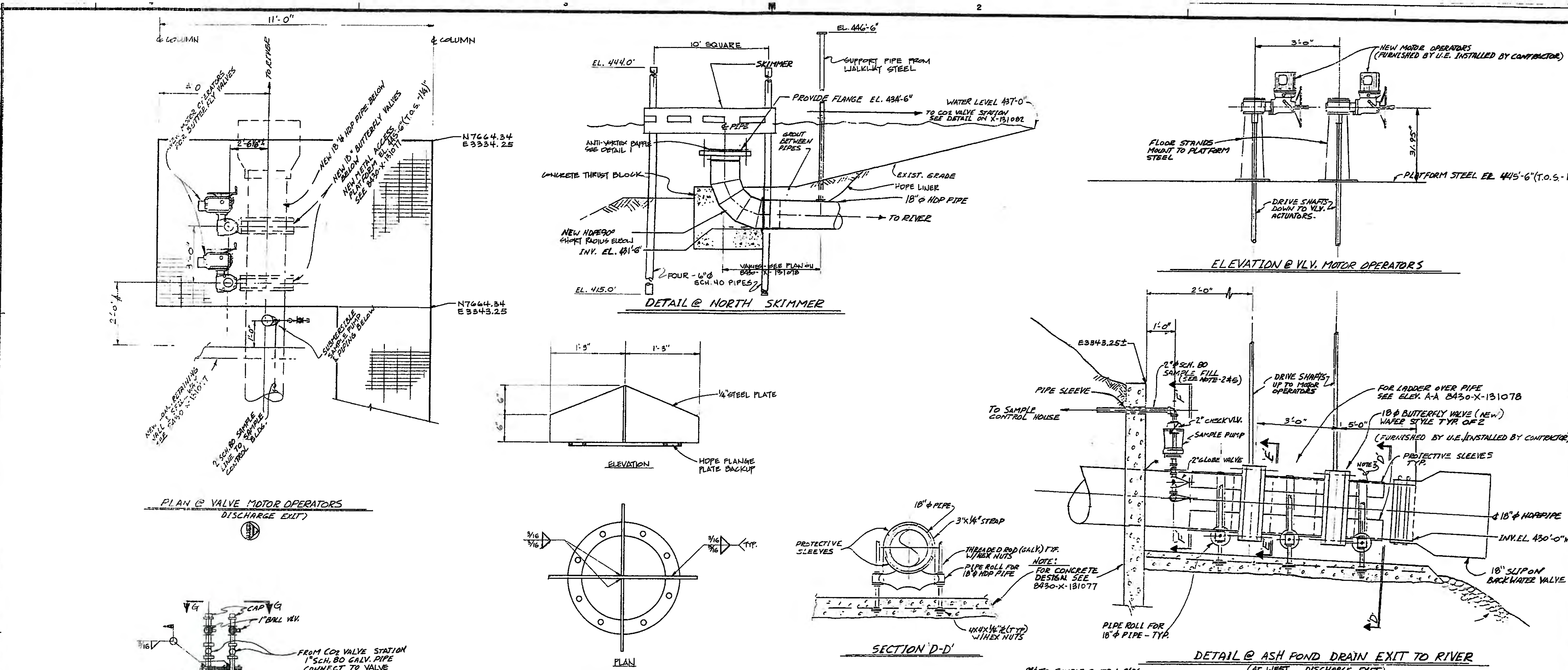
CIRCULATING WATER CONDUITS AND SUPPORTS IN YARD

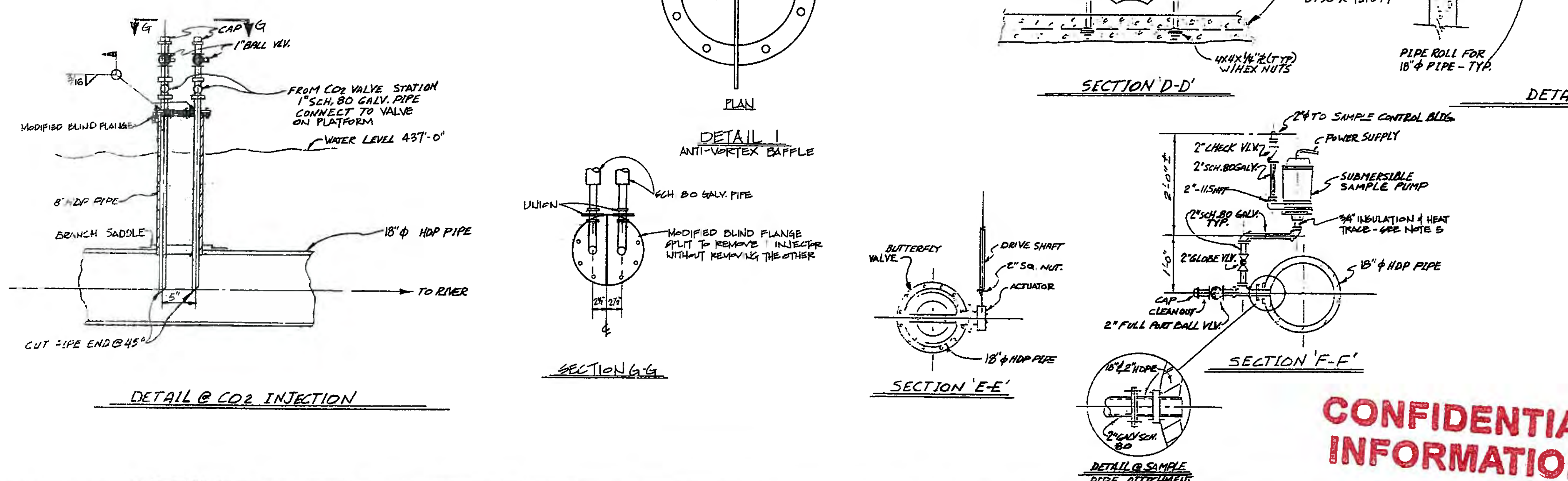
SCALE: 1" = 20'
DATE: 9/26/63
JOB:
U.E. DWG. NO. 8426-X-31019
U.E.&C. DWG. NO. 9049-F-1014

STATE OF MISSOURI ROBERT O. IMHOFF NUMBER E-10376 REGISTERED PROFESSIONAL ENGINEER



8430-X-131077
PLAN
DISCHARGE PLATFORM
DETAIL 1
LADDER & CAGE
SAFETY CHAIN
ELEVATION
ENLARGED PLAN
CONCRETE SPILLWAY
DETAIL 2
CORNER OF SPILLWAY
CONFIDENTIAL INFORMATION
DETAIL 3
END FOOTING
SECTION B-B
SECTION E-E
SECTION D-D
SECTION C-C
SECTION A-A
DETAIL 4
CENTER FOOTING
NOTES:
1. THIS WORK TO BE DONE IN ACCORDANCE WITH U.E. SPEC. No. EC-2799
2. ALL ANCHOR BOLTS TO BE 3/4" φ x 1'-6" LG. (U.N.O.) VERTICAL LENGTH WITH 3" HOOK, GALVANIZED.
REFERENCE DRAWINGS:
8430-X-128771 ----- PROPERTY PLAN
THIS DRAWING HAS NO SCALE
STRUCTURE - ASSEMBLY & DETAILS
NEW ASH POND
DISCHARGE STRUCTURE
SIOUX PLANT
UNION ELECTRIC COMPANY
ST. LOUIS, MO.
8430-X-131077





NOTES:
1. THIS WORK TO BE DONE IN ACCORDANCE WITH U.E. SPEC. No. EC-2779.
2. ALL 2"⌀ SCH. 80 PIPING ABOVE GROUND TO BE GALVANIZED. ALL 2"⌀ SCH. 80 PIPING BELOW GROUND TO BE COMMON CARBON STEEL.
3. ALL PIPING 2"⌀ & SMALLER TO BE SCHEDULE 80.
4. CONTRACTOR TO REAM PIPE FLANGES TO PERMIT FREE OPERATION OF 18"⌀ BUTTERFLY VALVES.
5. INSTALL ¾" INSULATION AND HEAT TRACE ON 18"⌀ PIPE FROM CONCRETE WALL TO LAST PIPE ROLL AND ON 2"⌀ PIPE FROM CONCRETE WALL TO 18"⌀ PIPE.
6. ALL HDP PIPE CONNECTIONS SHALL BE FUSION WELDED.

REFERENCE DRAWINGS:
8430-X-128772 ---- PROPERTY PLAN

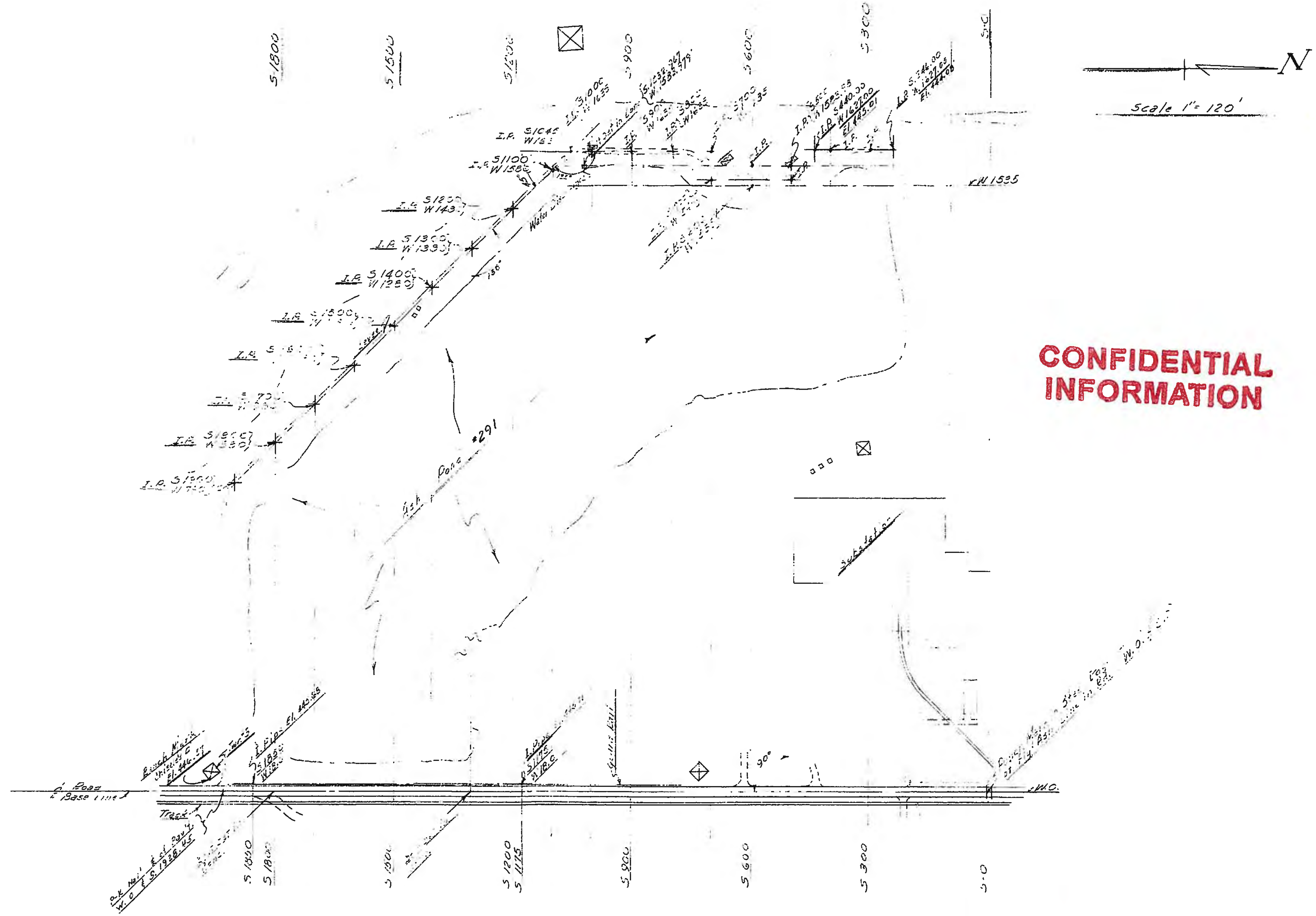
THIS DRAWING HAS NO SCALE

8430-X-131080

CONFIDENTIAL INFORMATION

STATE OF MISSOURI KARL D. GAUS NUMBER E-21805 REGISTERED PROFESSIONAL ENGINEER

DRAWN MIKE LOWRY	PIPING-INSTALLATION & DETAILS ASH POND DISCHARGE NEW ASH POND
CHKD. NOT CHKD.	
SUPV. STEVE OTT	
APPD.	LOCATION: SIOUX PLANT — CLASS 05030
UNION ELECTRIC COMPANY ST. LOUIS, MO.	8430-X-131080 — REV. 2



PRINT DIST.	
REVISIONS	
REV. 0	W.O. NONE
FIRST ISSUE	
ADDED P-K NAIL	
Title chgd Added Pond #291	

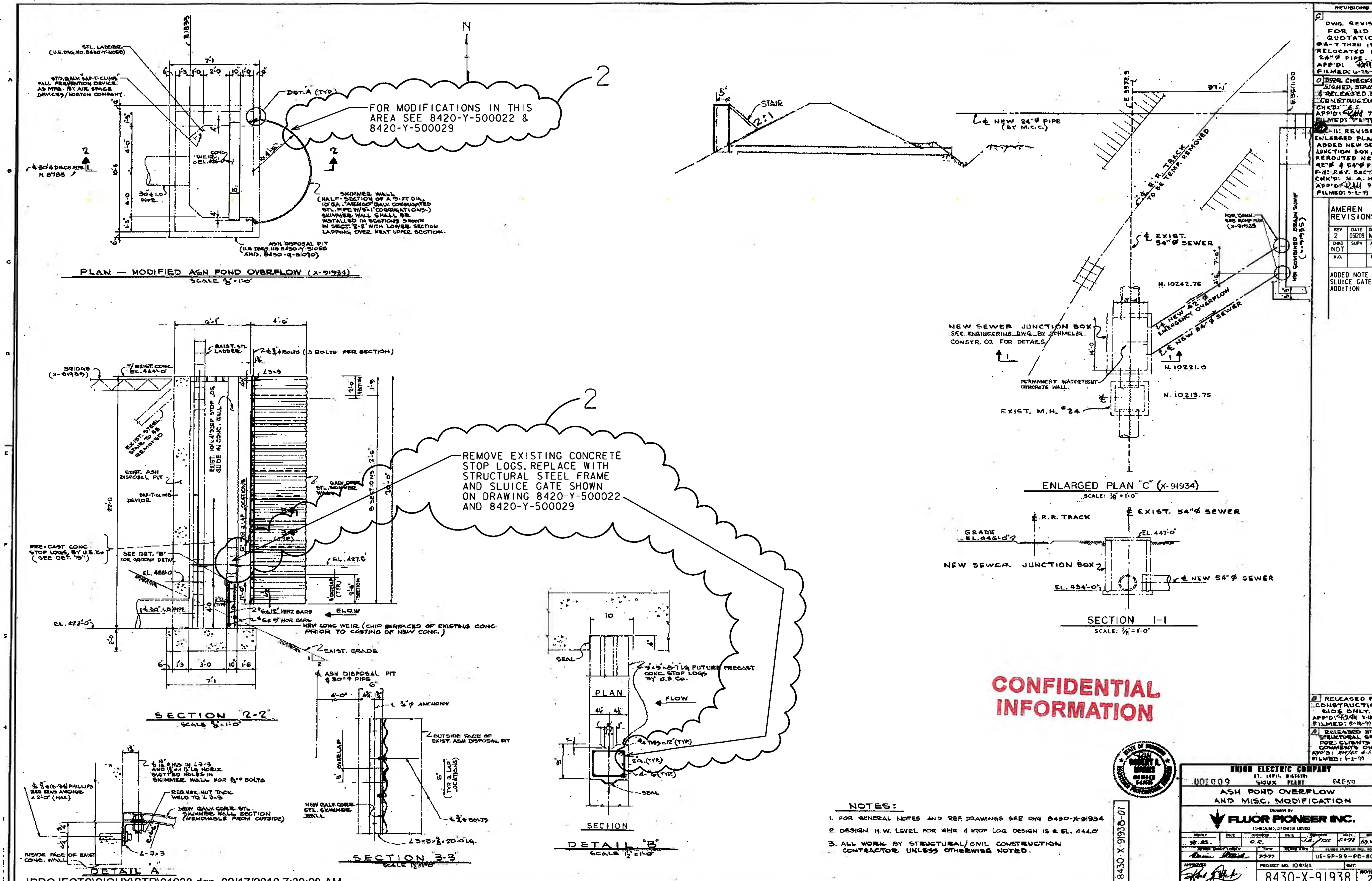
DRAWN 3-3-77

PROPERTY PLAN SURVEY
ASH POND #291
INSTRUMENT PT. LOC.

LOCATION 001009 SIOUX PLANT CLASS 02010

UNION ELECTRIC COMPANY ST. LOUIS, MO.

8400-Y-92817 REV. 4



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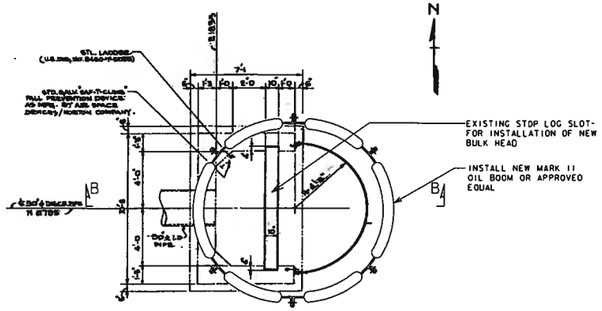
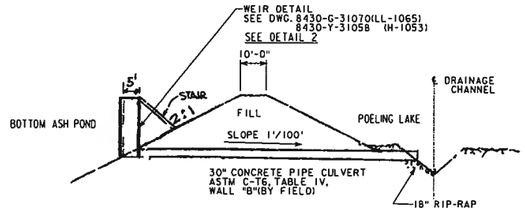
PRINT DIST.	8420-Y-500029
REVISIONS	
REV. 0 / W.O.	
FIRST ISSUE	

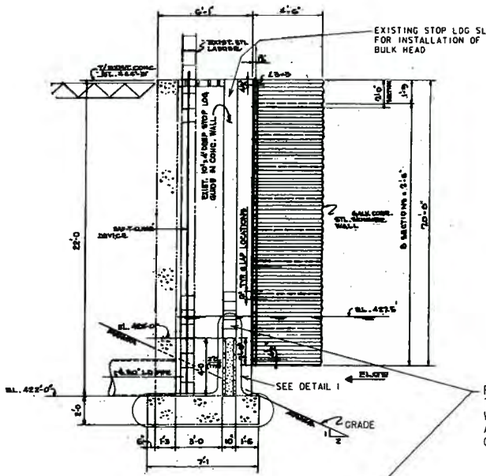


DETAIL I
PLAN-EXISTING BOTTOM ASH WATER CONTROL STRUCTURE



SECTION "A-A"

CONFIDENTIAL INFORMATION



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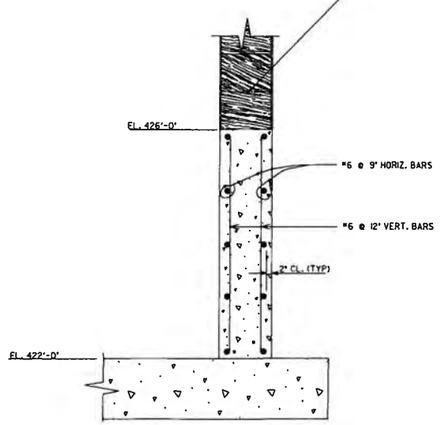
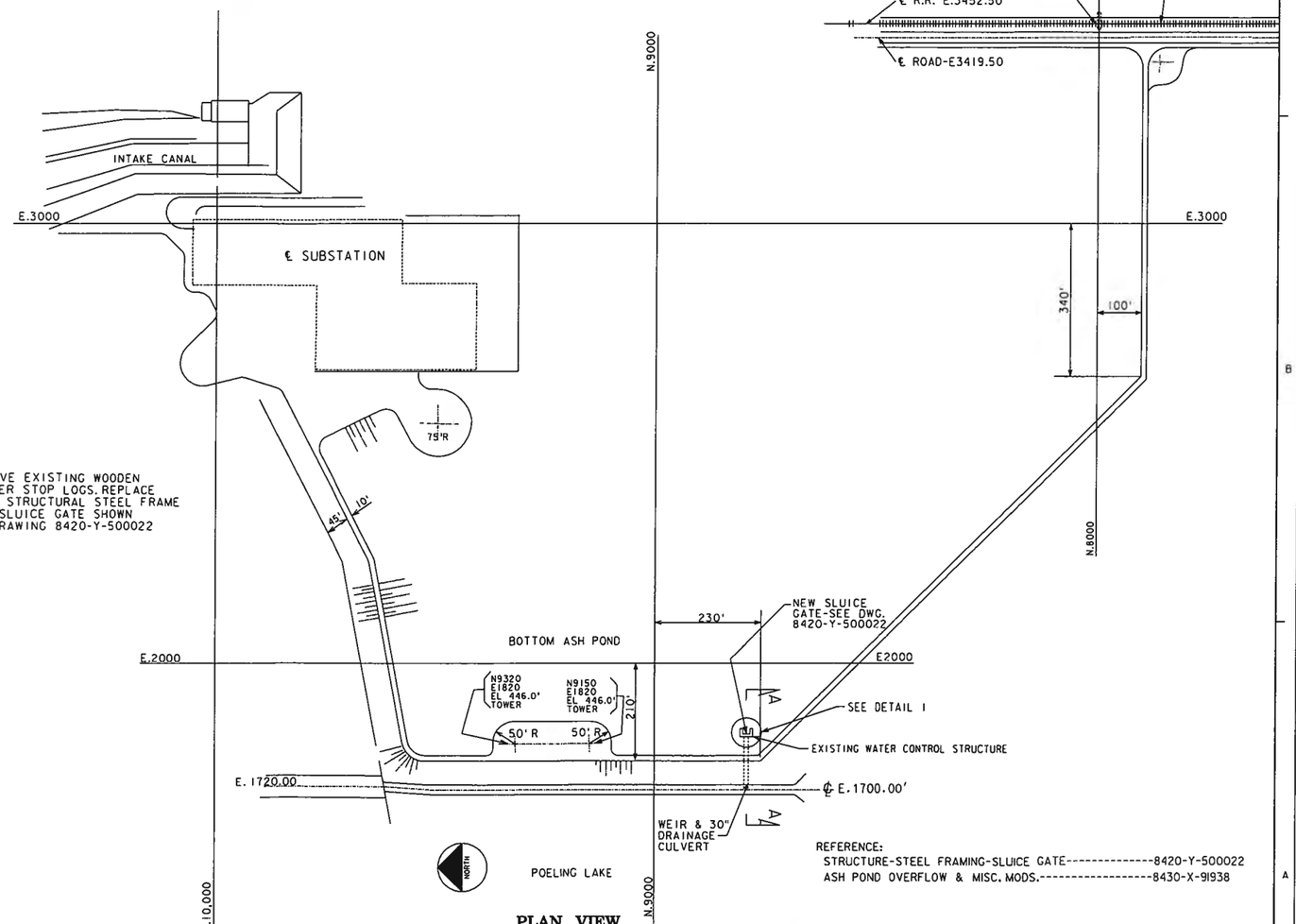
SECTION "B-B"



DETAIL 3



PLAN VIEW

REFERENCE:
STRUCTURE-STEEL FRAMING-SLUICE GATE----------8420-Y-500022
ASH POND OVERFLOW & MISC. MODS.----------8430-X-91938

NOTICE OF LIMITED RESPONSIBILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT DRAWINGS AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT ASSUME RESPONSIBILITY FOR ANY DESIGN WORK SHOWN ON OTHER PROJECT DRAWINGS OR DOCUMENTS UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

PREPARED FOR Ameren UE

DRAWN 5-29-09 MSB	STRUCTURE-STEEL-INSTALLATION BULKHEAD/SLUICE GATE & OIL SKIMMER FOR BOTTOM ASH POND WATER CONTROL STRUCTURE
CHKD. NOT CHK'D.	
SUPV. S.K. OTT	
APPD.	LOCATION 001009 SIOUX PLANT — CLASS 04060
Ameren ST. LOUIS, MISSOURI	8420-Y-500029 — REV. 0

3 2 1

J1-0-8 Rev. 9-85

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REVISIONS

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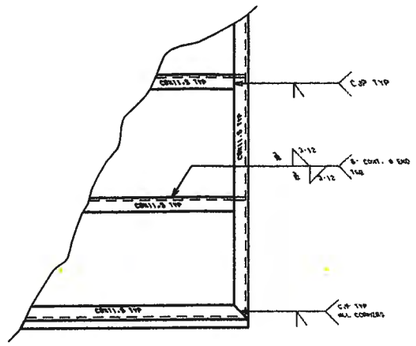
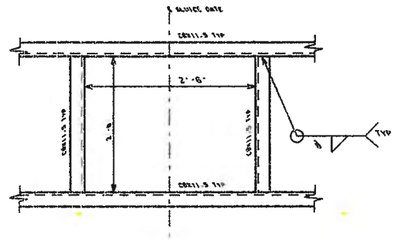


DETAIL 1



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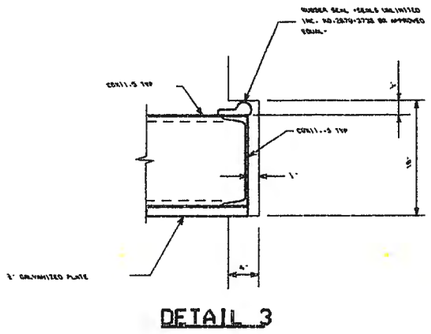
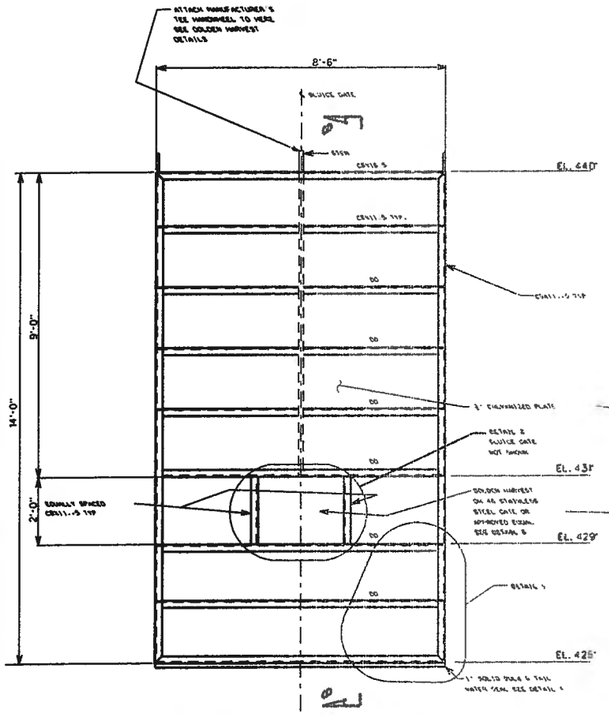
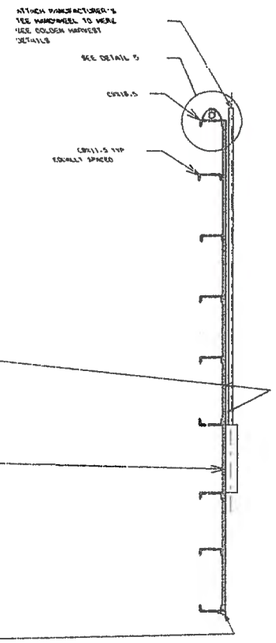


DETAIL 3

54



SECTION "A-A"



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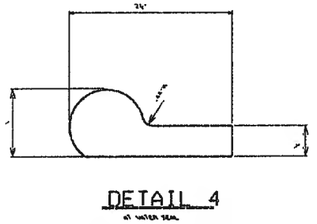
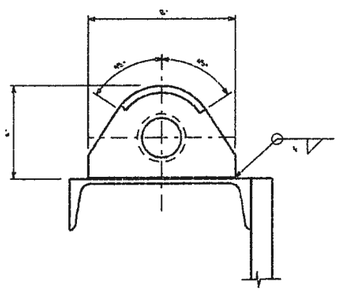


DETAIL 4

w/ WATER SEAL

RUBBER SEAL, "SEALS UNLIMITED INC. NO.2570-3738 OR APPROVED EQUAL"

NOTE: USE MANUFACTURER RECOMMENDED MOUNTING 4/1



DETAIL 5

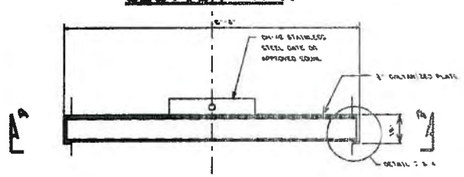
NOTE:
USE WINDLASS CORP 5 TON LIFTING LUG OR APPROVED EQUAL

DETAIL 6

GOLDEN HARVEST OR AS STAINLESS STEEL GATE OR APPROVED EQUAL

SECTION "C-C"

FOR SLUICE GATE



PLAN

NOTES:

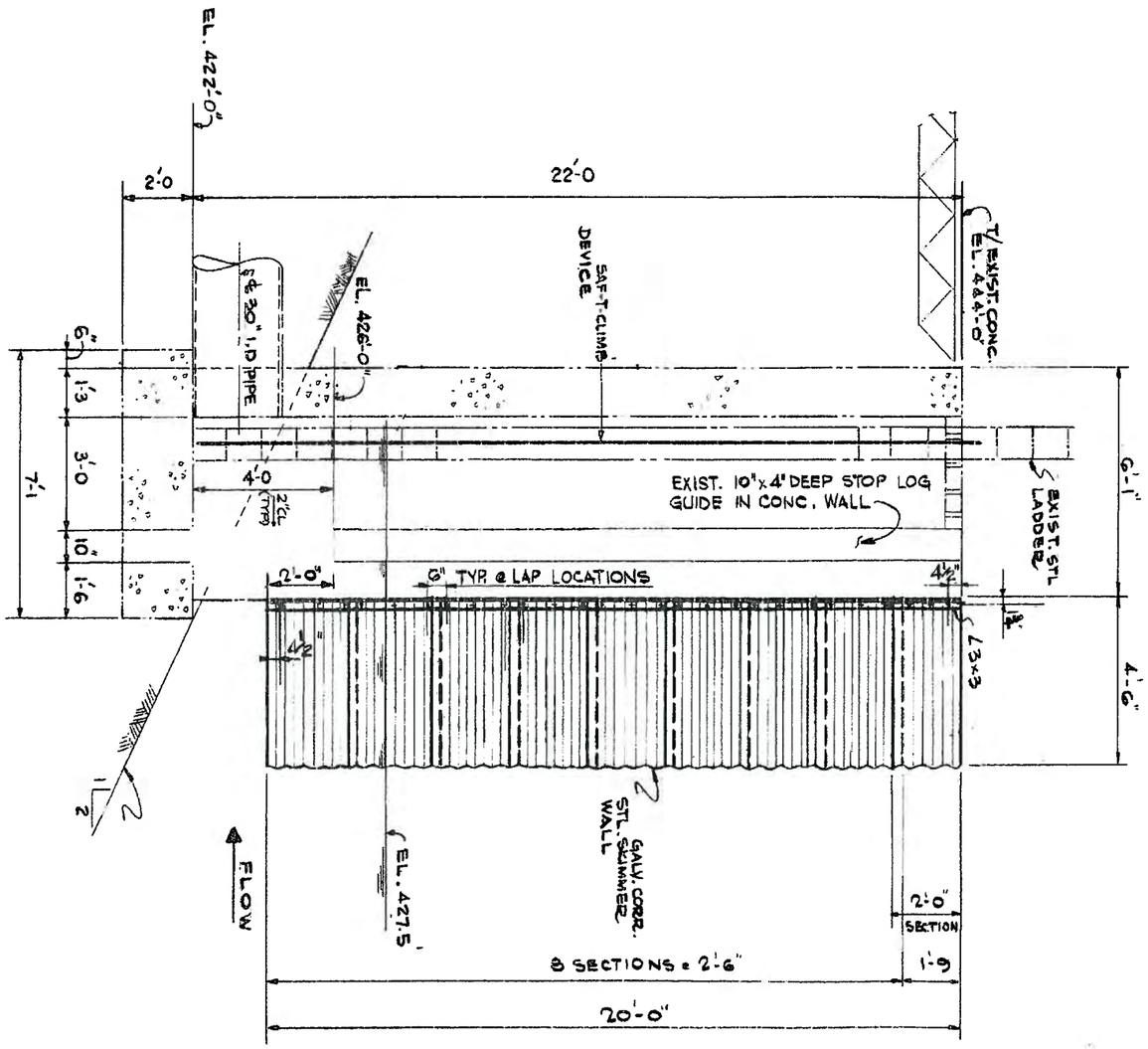
1. ALL STRUCTURAL STEEL WORK SHALL BE IN ACCORDANCE WITH THE "MANUAL OF STEEL CONSTRUCTION OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION" "AISC".
2. ALL STEEL SHALL CONFORM TO ASTM A36 AND SHALL BE GRADE 50 "ASTM A572 OR A992".
3. SUBMIT SHOP DRAWINGS TO ENGINEER. SHOP DRAWINGS SHALL INCLUDE COMPLETE DETAILS AND SCHEDULES FOR FABRICATION AND ASSEMBLY OF ALL COMPONENTS INCLUDING ALL SHOP AND AND FIELD CONNECTIONS. INDICATE WELDS BY STANDARD AWS A2.1 AND A2.4 SYMBOLS AND SHOW SIZE, LENGTH, AND TYPE OF WELD.
4. WELD CONSTRUCTION SHALL COMPLY WITH AWS CODE FOR PROCEDURES, APPEARANCE AND QUALITY OF WELDS, AND METHODS USED IN CORRECTING WELDING WORK.
5. ELECTRODES FOR WELD SHALL BE E70 FOR MANUAL ARC WELDING.
6. ALL STRUCTURAL MEMBERS TO BE HOT DIPPED GALVANIZED EXCEPT GATE.

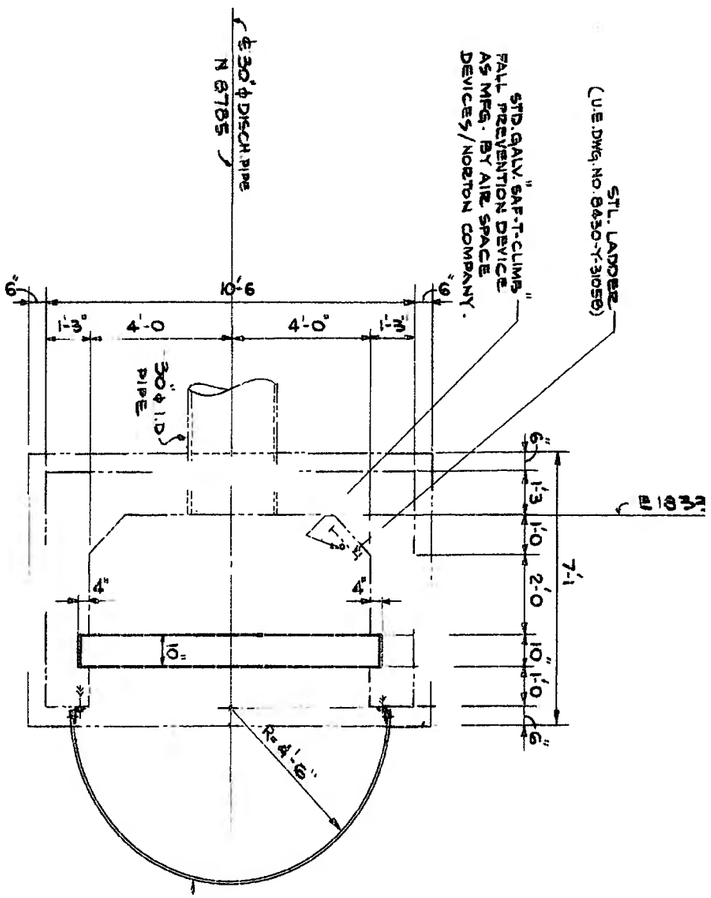
PREPARED FOR Ameren UE

DESIGNED	STRUCTURE STEEL FRAMING
DRAWN	SLUICE GATE
CHECKED	
SUPV.	
APPD.	
LOCATION	
CLASS	
REV.	

Ameren ST. LOUIS, MISSOURI

37-13-148 Rev. 9-85





CONFIDENTIAL INFORMATION

PRINT DIST.

REVISIONS

REV.	W.O.	
A	6163	

ISSUED FOR APPROVAL

ISSUED FOR BID

ISSUED FOR CONSTRUCTION

GENERAL REVISIONS ISSUED WITH C.O. #2 TO CONTRACT

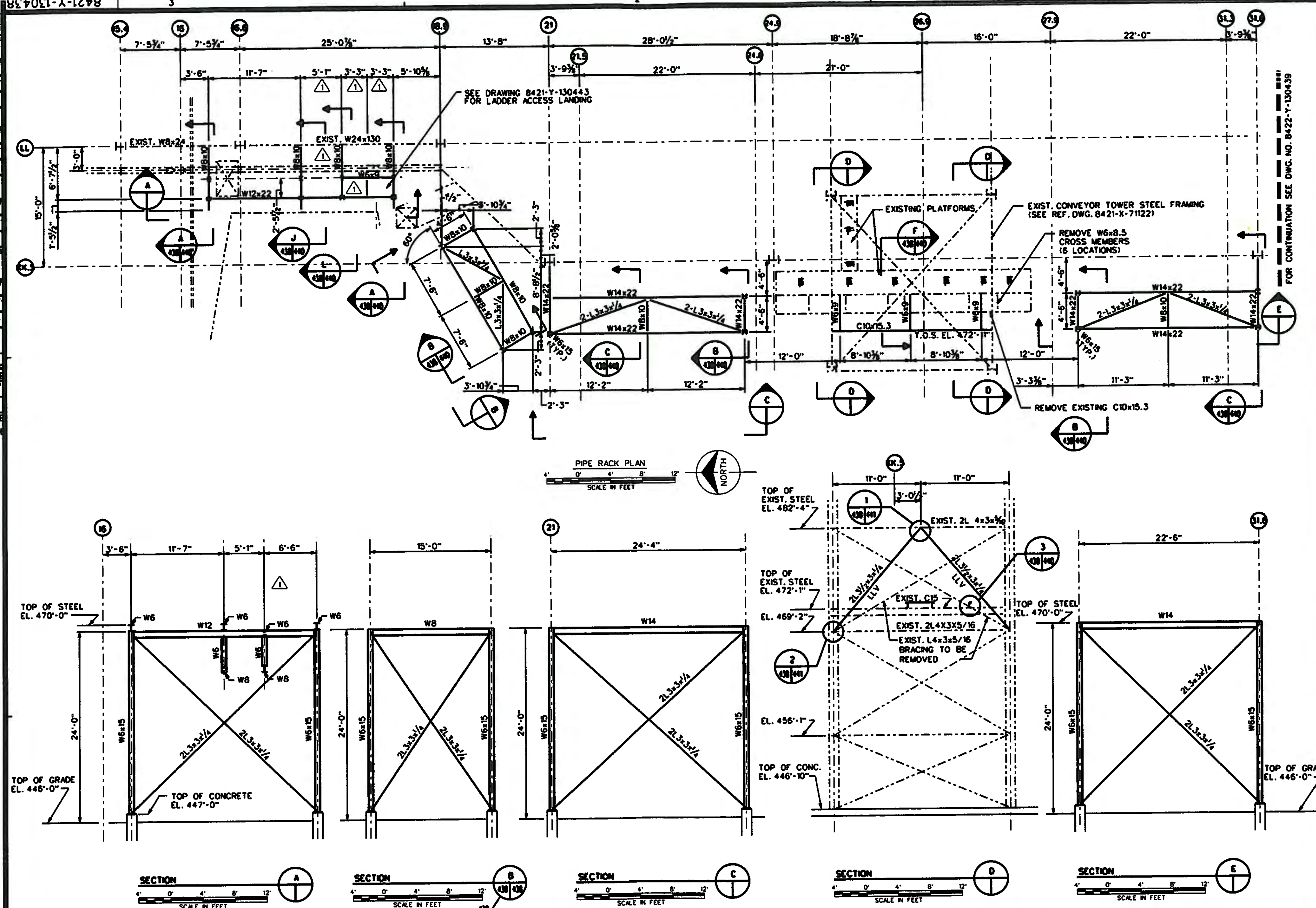
CONFORMING TO CONSTRUCTION RECORDS

U.E. REVISIONS

REV 3 DATE 020598 DRAWN MSS

W.O. 6163

REVISED TITLE ADDED SEAL AND BAR CODE



CONFIDENTIAL INFORMATION

NOTICE OF LIMITED RESPONSIBILITY

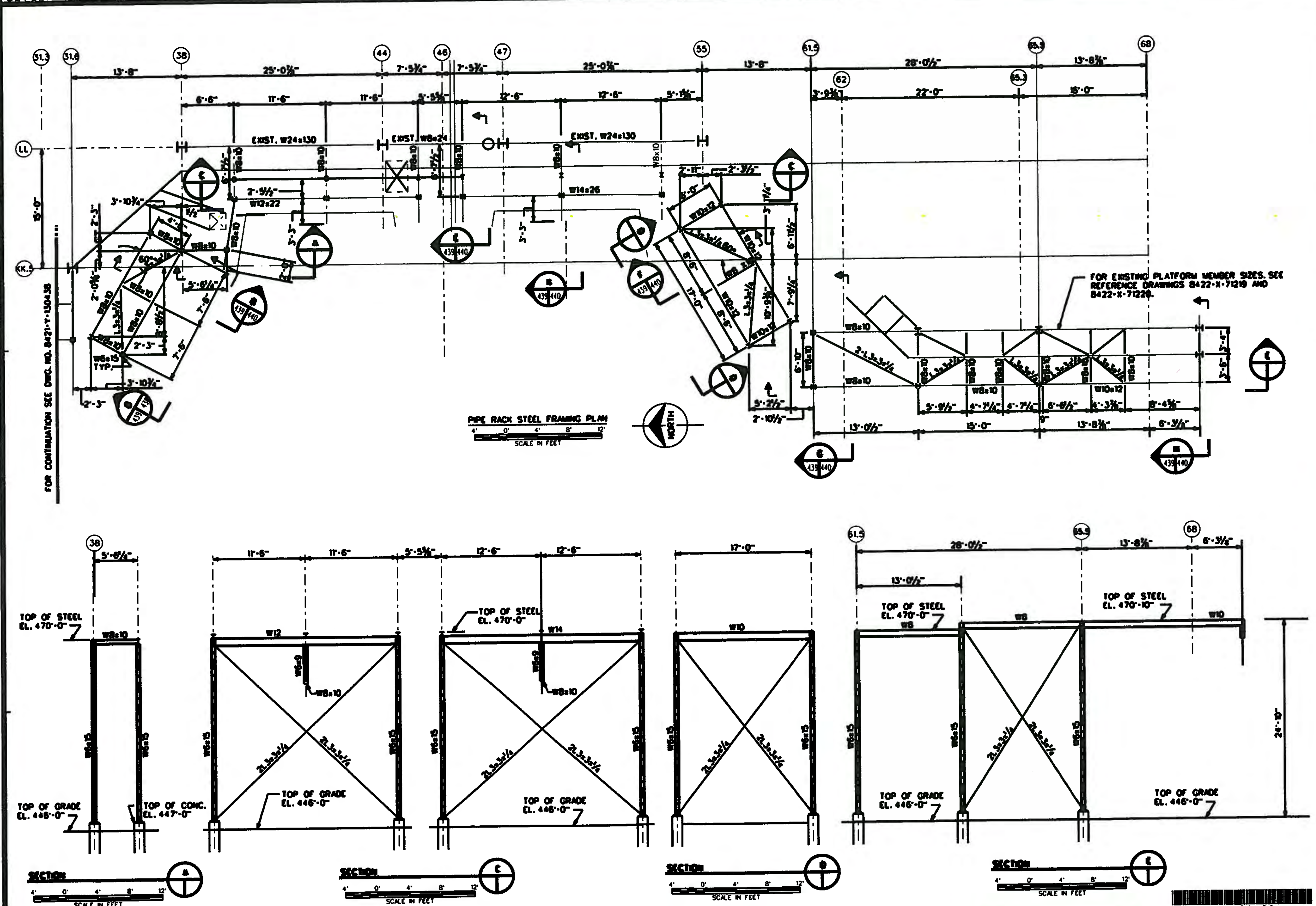
REV. 2 SEALED BY SCOTT D. RICHART E-19037 STATE OF MISSOURI BURNS/McDONNELL

STRUCTURE-STEEL FRAMING-UNIT-PLAN & ELEVATIONS PIPE RACKS FOR FLYASH PIPING TO ASH POND 1993 ASH HANDLING MODIFICATIONS

SIOUX PLANT

UNION ELECTRIC COMPANY ST. LOUIS, MO.

8421-Y-130438 REV. 3



PRINT DIST.		
REVISIONS		
REV. A	W.O. 684	10 8 93
ISSUED FOR APPROVAL		
ISSUED FOR BID		
ISSUED FOR CONSTRUCTION		
CONFORMING TO CONSTRUCTION RECORDS		
U.E. REVISIONS		
REV 2	DATE 020596	DRAWN MSE
CHKD NOT	SUPV -	APPD -
W.O. 6163		FILM
REVISED TITLE, ADDED SEAL AND BAR CODE		

8422-Y-130439

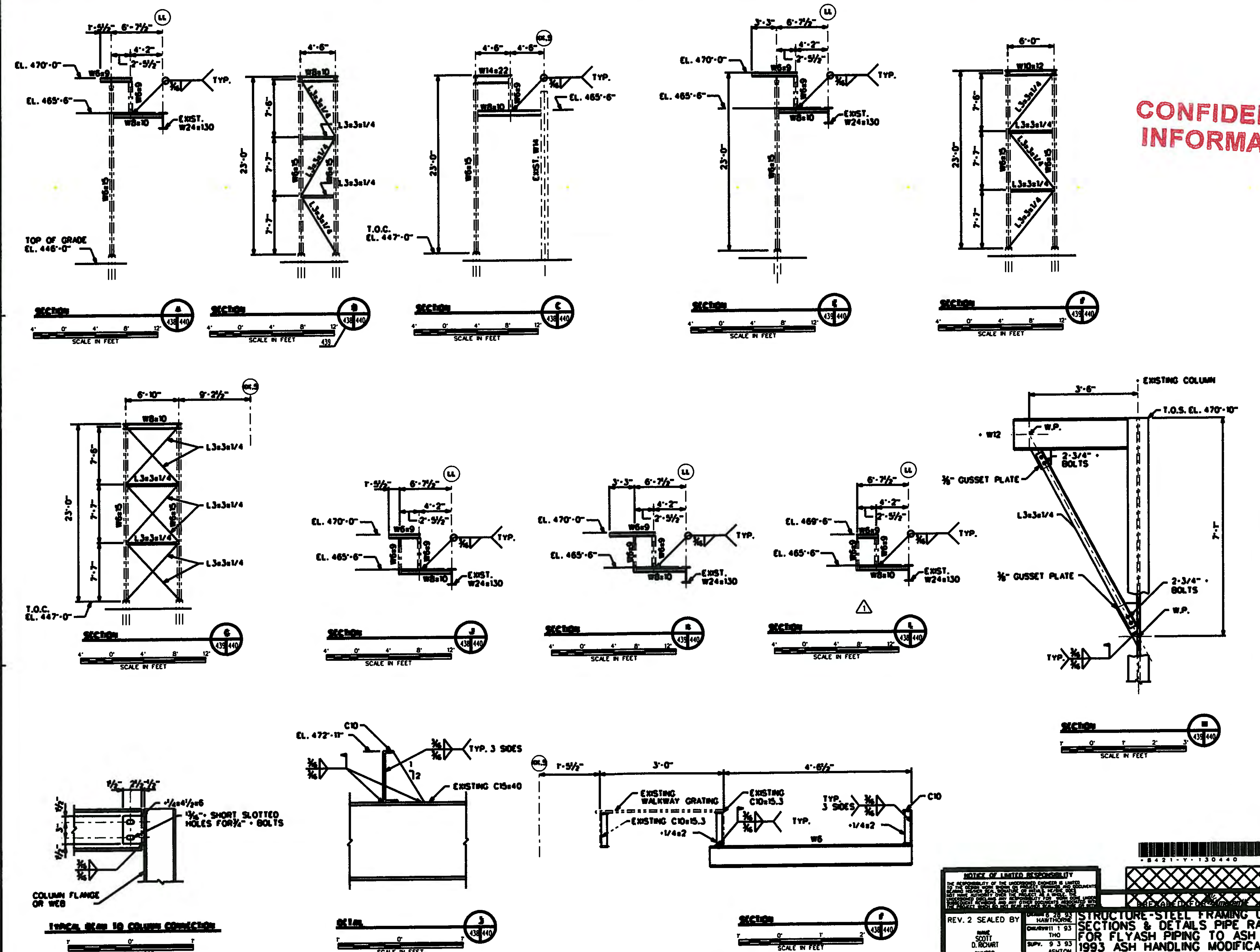
CONFIDENTIAL INFORMATION

NOTICE OF LIMITED RESPONSIBILITY

REV. 1 SEALED BY
SCOTT D. RICHART
E-19037
STATE OF MISSOURI
BURNS/MCDONNELL

DRAWN 5 28 93 ROUTON	STRUCTURE-STEEL FRAMING UNIT #2 PLAN & ELEVATIONS PIPE RACKS FOR FLYASH PIPING TO ASH POND 1993 ASH HANDLING MODIFICATIONS
CHK/RVW 11 1 93 THO	
SUPV. 9 2 93 ASHTON	
APPD. 11 5 93 RICHART	LOCATION 001009 — CLASS 04060

Ameren — ST. LOUIS, MISSOURI — 8422-Y-130439 — REV. 2



REVISIONS: ISSUED FOR APPROVAL; ISSUED FOR BID; ISSUED FOR CONSTRUCTION; GENERAL REVISION ISSUED WITH C.O. #2 TO CONTRACT C-1; CONFORMING TO CONSTRUCTION RECORDS; U.E. REVISIONS — REVISED TITLE, ADDED SEAL AND BAR CODE

8421-Y-130440

NOTICE OF LIMITED RESPONSIBILITY

REV. 2 SEALED BY
SCOTT D. RICHART
E-18037
STATE OF MISSOURI
BURNS/MCDONNELL

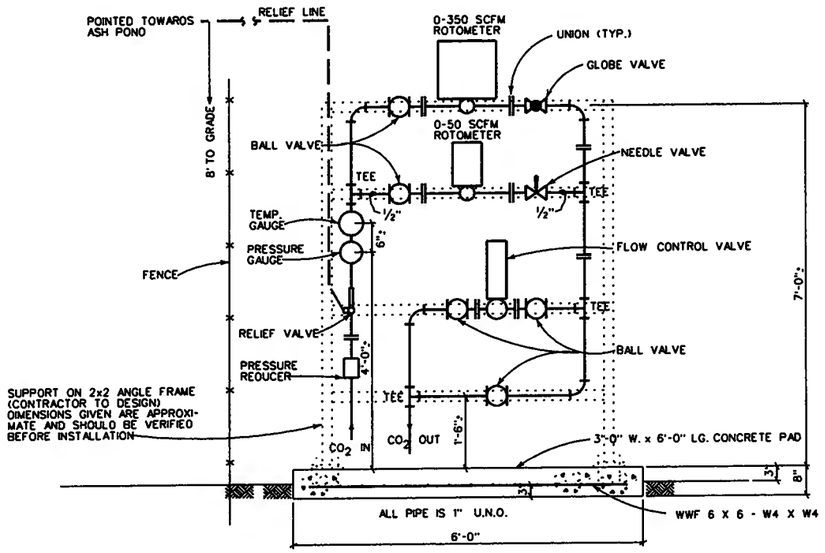
DRAWN	6 28 93 HAWTHORNE
CHK./REV.	11 1 93 THO
SUPV.	9 3 93 ASHTON
APPD.	11 5 93 RICHART

STRUCTURE-STEEL FRAMING UNIT-
SECTIONS & DETAILS PIPE RACKS FOR FLYASH PIPING TO ASH POND
1993 ASH HANDLING MODIFICATIONS

LOCATION 001009 | CLASS 04060

Ameren — ST. LOUIS, MISSOURI

8421-Y-130440 | REV. 3



DETAIL 1
CO_2 REGULATING STATION
LOOKING WEST

EQUIPMENT LIST	
PRESSURE GAUGE	ASHCROFT "DURAGAUGE" #1349SS 4½" BACK ½" NPT 0-100 psig, AISI 316SS BOURDON SYSTEM, 4½" FACE, BACK STEM, ½" NPT, ALUMINUM CASE, COLOR BLACK.
TEMPERATURE GAUGE	ASHCROFT INDUSTRIAL BIMETAL THERMOMETER, CODE 50C160R025, -20/120 F 5" DIA DIAL, ½" NPT REAR CONNECTION, 2½" STEM.
ROTOMETER	DIRECT READING CO_2 FLOWMETER, 0-350 SCFM, 1" NPT CONNECTIONS.
ROTOMETER	DIRECT READING CO_2 FLOWMETER, 0-40 SCFM, ½" NPT CONNECTIONS.
CONTROL VALVE	1" NPT CONNECTIONS, FURNISHED BY UNION ELECTRIC CO.
PRESSURE REDUCING VALVE CO_2	CASHCO PRESSURE REDUCING REGULATOR, TYPE 1000 HP, 1" NPT CONNECTIONS, BRASS BODY, OPTION 1000-5 FOR CRYOGENIC SERVICE, 40-80 psig SPRING RANGE, 300#/hr MAX FLOW, 300 psig INLET PRESSURE, 50 psig OUTLET PRESSURE.
RELIEF VALVE CO_2	CASHCO RELIEF VALVE, MODEL 1164, 1" NPT CONNECTIONS, BRONZE BODY, OPTION 5 FOR CRYOGENIC SERVICE, 300#/hr MAX FLOW, 70-150 psig SPRING RANGE, RELIEVE AT 90 psig.

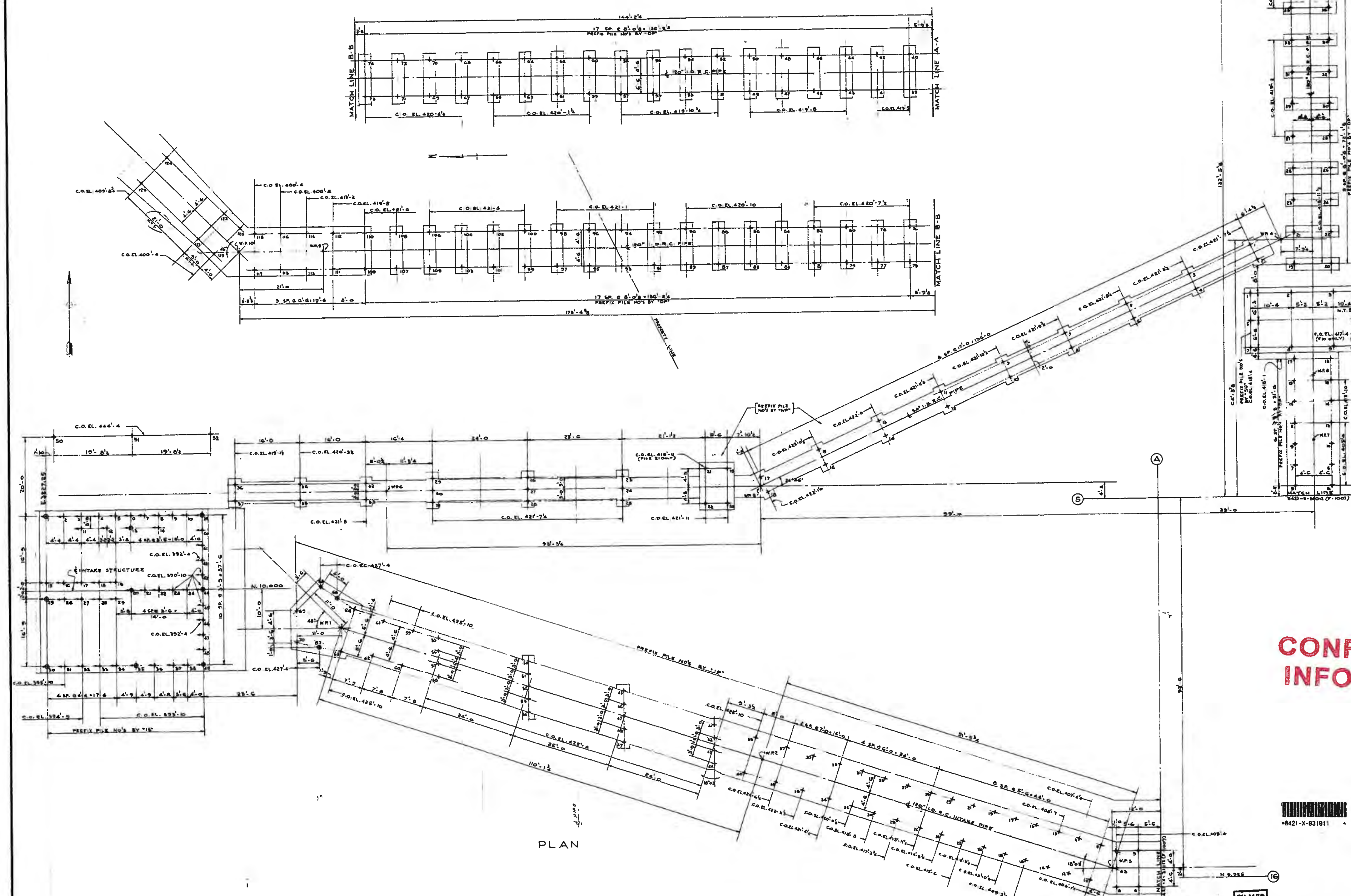
NOTES:

1. THIS WORK TO BE DONE IN ACCORDANCE WITH U.E. SPEC. NO. EC-2799.

REFERENCE DRAWINGS:

THIS DRAWING HAS NO SCAL

DRAWN MIKE LOWRY	PIPING-INSTALLATION AND DETAIL CO_2 REGULATING STATION NEW ASH POND
CHKD. NOT CHKD.	
DES. STEVE OTT	
APPD.	LOCATION 001009 SIOUX PLANT 0503
UNION ELECTRIC COMPANY ST. LOUIS, MO.	8430-X-131082 REV 0



NOTES:
1. FOR NOTES SEE DWG. 8421-X-31012 (F-1007)
2. FOR C W CONDUITS & SUPPORTS SEE DWG. 8426-X-31019 (F-1014)
3. PILES SHOWN THUS ⟶+ ARE 12 BP 53 BATTERED PILES BATTER SHALL BE 15° IN DIRECTION OF ARROW.

TABLE OF REVISIONS
USE ONLY PRINTS SHOWING LATEST REVISION

STATE OF MISSOURI
ROBERT O. IMHOFF
NUMBER E-10376
REGISTERED PROFESSIONAL ENGINEER

TABLE OF REVISIONS
USE ONLY PRINTS SHOWING LATEST REVISION

UNITED ENGINEERS & CONSTRUCTORS INC.
PHILADELPHIA

FILMED

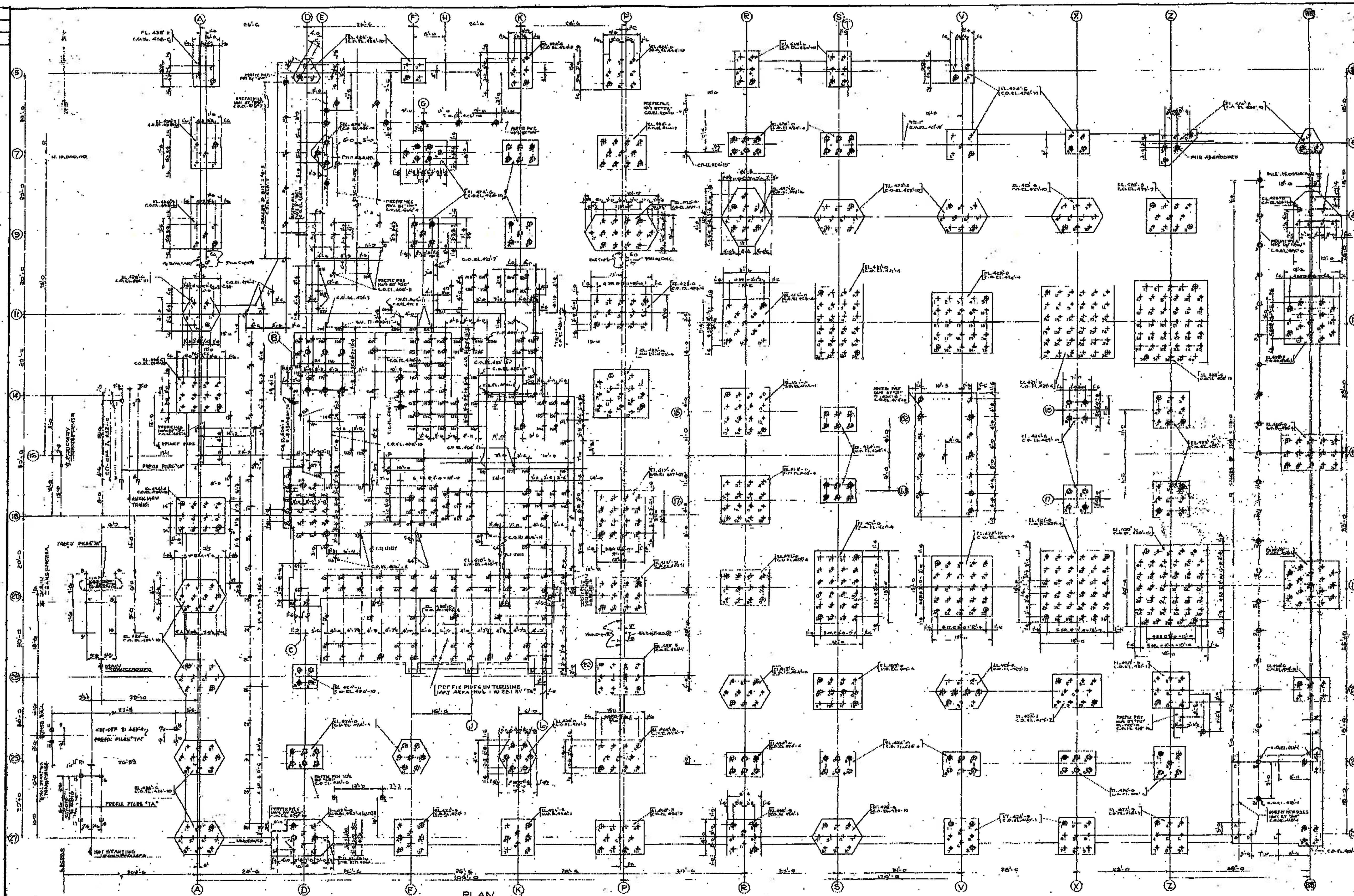
UNION ELECTRIC COMPANY
SIOUX POWER PLANT - UNIT NO. 1

EXCAVATION & PILE PLAN
FOR CIRCULATING WATER CONDUITS
AND INTAKE STRUCTURE

SCALE: 1/8" = 1'-0
DATE: 11/21/63
JOB:

U.E. DWG. NO. 8421-X-31011
U.E.&C. DWG. NO. 9049-F-1006

8421-X-031011



DETAIL "A"

SECTION 1-1

NOTES:

1. ALL PILES TO BE DRIVEN TO ROCK. DRIVING AND SPLICES TO BE IN ACCORDANCE WITH SPECIFICATION 9945-W-1
2. ALL PILES SHOWN THUS ✦ ARE 70 TON DESIGN LOAD 12 BP 53 PILES
3. ALL PILES SHOWN THUS ⊕ ARE 70 TON DESIGN LOAD 12 BP 53 PILES ANCHORED IN PILE CAP AS SHOWN ON DETAIL "A"
4. ALL PILES SHOWN THUS ⊕ ARE 70 TON DESIGN LOAD 12 BP 53 PILES WITH GROUNDING WIRE ATTACHED (SEE DWGS. 8406-X-8872 & X-31674 FOR DETAILS.)
5. ALL PILES SHOWN THUS ⊕ ARE 70 TON DESIGN LOAD 12 BP 53 PILES ANCHORED IN PILE CAP WITH GROUNDING WIRE ATTACHED (SEE DET. "A" AND DWGS. 8401-X-31625 & X-31624
6. ALL PILES SHOWN THUS ⊕ ARE 100 TON DESIGN LOAD 14 BP 73 TEST PILES.
7. " " " " ⊕ ARE 70 TON DESIGN LOAD 12 BP 53 TEST PILES.
8. " " " " ⊕ ARE 50 TON DESIGN LOAD 10 BP 42 TEST PILES.
9. ALL TEST PILES TO BE UTILIZED UNLESS THEY INTERFERE WITH DRIVING, BY OTHER NEW PILES TO SUIT.
10. ELEVATIONS SHOWN THUS (EL. 424'-6) DENOTE ELEVATION OF BOTTOM OF PILE CAP. ELEVATIONS SHOWN THUS (C.O. EL. 424'-10) DENOTE ELEV. OF PILE CUT OFF.
11. ALL PILE NUMBERS TO BE PREFIXED BY COLUMN NUMBER, UNLESS OTHERWISE NOTED.
12. THE ALL PILES PREFIXED BY "EV" & "VW" WITH SINGLE CONTINUOUS NO. BAR, WELDED TO EACH PILE.
13. ALL PILES SHOWN THUS D ARE 50 TON DESIGN LOAD 10 BP 42.
14. " " " " ⊕ " " " " 10 BP 42 ANCHORED IN PILE CAP AS SHOWN ON DETAIL "A"

CONFIDENTIAL INFORMATION

FILMED

8421-X-831812

UNION ELECTRIC COMPANY

SIOUX POWER PLANT - UNIT NO. 1

EXCAVATION & PILE PLAN

TURBINE & BOILER AREA

SCALE: 1/8" = 1'-0", UNLESS NOTED

U/E DWG. NO. 8421-X-31812

DO NOT SCALE THIS DRAWING

RIVER

STATE HIGHWAY NO. 64

TYPICAL R.R. ROADBED SECTION
NORTH OF STATE HIGHWAY NO. 64

SECTION 1-1

SECTION 2-2

SECTION X-X

SECTION Y-Y

SECTION 3-3

TYPICAL PAVEMENT JOINT DETAILS

TYPICAL PAVING DETAIL @ R.R. CROSSING

SECTION 4-4

SECTION 5-5

SECTION 6-6

SECTION 7-7

EXCAVATIONS & FILL FOR PLANT SITE AND R.R. TRACK LAYOUT

SIOUX PLANT

8430-X-31008

SUPERSEDES 8430-X-31008 REV 20 DATE 5-20-93

SCANNED HYBRID DRAWING

SCALE RATIO - 200
THIS DRAWING HAS BEEN REFERENCED TO FILE(S):

CONFIDENTIAL INFORMATION

CONFIDENTIAL INFORMATION

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APPENDIX A

Document 4

Ameren Missouri Responses to Requests for Information

Ameren
MISSOURI

October 6, 2010

Mr. James Filson, P.E.
Associate
Dewberry
8401 Arlington Boulevard
Fairfax, VA 22031

Re: United States Environmental Protection Agency
Ash Pond Inspection - Request for Data

Dear Mr. Filson:

Enclosed is one (1) copy of each of the documents you requested during your EPA required inspections of the ash pond embankments at Ameren's Rush Island, Meramec, and Sioux Power plants on September 29 and 30, 2010. Each of the documents has been reviewed by Ameren's Legal department. Certain categories of documents have been stamped "confidential" as appropriate. These documents should be treated as "Confidential Business Information" and the Company reserves its rights with respect to the public release or use of such information. We understand that the use of these documents will assist you in assessing the structural integrity of the ash pond embankments and will be destroyed upon completion of the assessment reports. The stability analysis that you requested for the Sioux and Meramec ash ponds is ongoing and will be submitted to you upon completion.

If you need further information, please feel free to contact me at 314-957-3426.

Sincerely,

Matthew K. Frerking P.E.
Managing Supervisor, Dam Safety

Enclosures

1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
AmerenMissouri.com

AmerenUE Response

Sioux Power Station
8501 North State Route 94
West Alton, Missouri 63386

1. Coal-combustion by-product surface impoundments at this Station are not classified as dams by State or Federal regulatory agencies so they have not been rated.

2. See table below.

Management Unit	Year Commissioned or Expanded
Fly Ash Pond	1994
Ash Pond	1967

None of these units have been expanded.

3. See table below.

Management Unit	Materials Contained in Unit*
Fly Ash Pond	1, 5
Ash Pond	1, 3, 5

*Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other.

Other types of materials that are temporarily or permanently contained in the unit(s) include, but are not limited to residual wastes remaining following treatment of wastewater from these systems: primary water treatment; boiler water make-up treatment; sanitary wastewater treatment; laboratory and sampling streams; boiler blowdown; floor drains; coal pile run off; house service water systems; and pyrites.

4. The management units at this facility were designed by a Professional Engineer. The construction of the management units were done under the supervision of a Professional Engineer. And, inspection and monitoring of the safety of the waste management units is under the supervision of a Professional Engineer.

5. The most recent annual internal professional engineering inspection of the management units occurred in 2009. Since these management units are not classified by regulation as dams the evaluation only included a visual inspection of the units. AmerenUE has formed a Dam Safety Group consisting of civil and geotechnical engineers who oversee the implementation

of the company Dam Safety Program and this Group is supervised by a licensed Professional Engineer. The Dam Safety Program requires routine, annual and special inspection of the ash ponds and employees performing these inspections receive dam safety training. If maintenance issues are identified in these visual inspections, then corrective actions are taken by either plant employees or contractors to remedy the issue and final acceptance of the work is reviewed and evaluated by Dam Safety Group personnel.

6. No State, or Federal regulatory official has inspected or evaluated the safety (structural integrity) of the management unit(s), and we are not aware of a planned state or federal inspection or evaluation in the future.

7. Not applicable, see response to Question 6.

8. See table below.

Management Unit	**Surface Area (Acres)**	**Total Storage Capacity (Acre-ft)**	**Volume of Stored Ash (Acre-ft)**	**Maximum Height of Unit (ft.)**
Fly Ash Pond	60	960	676	22
Bottom Ash Pond	47	2,100	1,859	27

9. Assuming that brief history means incident(s) which could have occurred in the last ten (10) years, we are not aware of any spills or unpermitted releases of coal-combustion by-products from our surface impoundments to surface water or to the land.

10. The current legal owner and operator at the facility is AmerenUE

Ameren Services

Environmental Services
314.554.2388 (Phone)
314.554.4182 (Facsimile)
ppike@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149

May 4, 2009

Mr. Richard Kinch
US Environmental Protection Agency (53306P)
!200 Pennsylvania Avenue, NW
Washington, DC 20460

Ameren

RE: Request for Information under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

This letter is in response to the letter sent to Mr. Thomas Voss who is the Chief Executive Officer of AmerenUE regarding the United States Environmental Protection Agency's request for information relating to the surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals.

AmerenUE operates four coal-fired power stations in Missouri and responses for those facilities were sent to you within the required ten (10) business days of receipt of their letters. AmerenUE has no additional facilities which have surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals.

Although our surface impoundments are not considered to be dams by State or Federal regulations, we are subject to State and Federal NPDES regulations and have had Agency personnel inspect these units. We are providing a full and complete response to each separate request for information set forth in your Enclosure A (attached) with responses corresponding to numbering in your questions. If you have any further questions please feel free to contact Paul Pike at (314) 554-2388.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Sincerely,

Michael L. Menne
Vice President – Environmental Services

Ameren Services

Environmental Services
314.554.2388 (Phone)
314.554.4182 (Facsimile)
ppike@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149

March 26, 2009

Mr. Richard Kinch
US Environmental Protection Agency (53306P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Request for Information under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

This letter and attachments are AmerenUE's response to the United States Environmental Protection Agency's request for information relating to the surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals.

AmerenUE operates four coal-fired power stations in Missouri. Although our surface impoundments are not considered to be dams by State or Federal regulations, we are subject to State and Federal NPDES regulations and have had Agency personnel inspect these units. We are providing a full and complete response to each separate request for information set forth in your Enclosure A (attached) with responses corresponding to numbering in your questions. If you have any further questions please feel free to contact Paul Pike at (314) 554-2388.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my

knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Sincerely,

Michael L. Menne
Vice President – Environmental Services

APPENDIX A

Document 5

Missouri Department of Natural Resources
Permit No. MO-0000353

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.:	MO-0000353
Owner:	Union Electric Company dba AmerenUE
Address:	One Ameren Plaza, PO Box 66149 (MC 602), St. Louis, MO 63166
Continuing Authority:	Same as above
Address:	Same as above
Facility Name:	AmerenUE, Sioux Power Plant
Address:	8501 North State Route 94, West Alton, MO 63386
Legal Description:	USG Survey 1838, T48N, R6E, St. Charles County
Receiving Stream:	Mississippi River (P)
First Classified Stream and ID:	Mississippi River (P) (00001)
USGS Basin & Sub-watershed No.:	(07110009-030004)

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

See page 2

This permit authorizes only wastewater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with Section 644.051.6 of the Law.

April 16, 2004
Effective Date

Stephen M. Mahfood, Director, Department of Natural Resources
Executive Secretary, Clean Water Commission

April 15, 2009
Expiration Date

Jim Hull, Director of Staff, Clean Water Commission

FACILITY DESCRIPTION (continued)

Outfall #001 - Power Plant - SIC #4911
Non-contact cooling water discharge.
Design flow is 1,344 MGD.
Actual flow is 863 MGD.

Outfall #002 - Power Plant - SIC #4911
Ash pond/pH neutralization.
Design flow is 16.662 MGD.
Actual flow is 4.855 MGD.

Outfall #002A - Power Plant - SIC #4911
Flow equalization/extended aeration/sludge holding tank/sludge disposal is by contract hauler.
Design population equivalent is 170.
Design flow is 0.039 MGD.
Actual flow is 0.005 MGD.
Design sludge production is 3.06 dry tons/year.

Outfall #003 - Power Plant - SIC #4911
Emergency overflow from the combined drain sump.
Design flow is 3.48 MGD.

Outfalls #004 & #005 - Power Plant - SIC #4911
These outfalls still exist but are not currently being monitored due to Implementation of Best Management Practices & minimal risk to waters of the state.

Outfall #006 - Power Plant - SIC #4911
Ash pond #2/pH neutralization.
Design flow is 13.656 MGD.
Actual flow is 5.64 MGD.
This outfall will receive storm water from chipped tire pile.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective upon issuance and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001 - Non-Contact Cooling Water						
Flow	MGD	*		*	once/weekday**	24 hr. estimate
Intake Water Temperature	°F	*		*	once/weekday**	grab
Effluent Temperature	°F	*		*	once/weekday**	grab
Thermal Discharge (Internal Energy Increase)	btu/hr	5.50×10^9			once/weekday**	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE June 28, 2004.						
Whole Effluent Toxicity (WET) Test	% Survival	See Special Condition #1			once/year	grab
MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE October 28, 2004.						
Outfall #002 - Ash Pond						
Flow	MGD	*		*	once/week	24 hr. estimate
Intake Total Suspended Solids***	mg/L	*		*	once/week	grab
Effluent Total Suspended Solids***	mg/L	*		*	once/week	grab
Net Total Suspended Solids	mg/L	100		30	once/week	grab
Oil and Grease	mg/L	20		15	once/month	grab
pH - Units	SU	****		****	once/week	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE June 28, 2004.						
Sulfate (as SO_4^{-2})	mg/L	*		*	once/quarter*****	grab
MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE July 28, 2004.						
Whole Effluent Toxicity (WET) Test	% Survival	See Special Condition #1			once/year in January	grab
MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE October 28, 2004. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.						

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 and August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective upon issuance and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #002A - Sewage Treatment Plant						
Flow	MGD	*		*	once/month	24 hr. estimate
Biochemical Oxygen Demands	mg/L		45	30	once/quarter*****	******
Total Suspended Solids	mg/L		45	30	once/quarter*****	******
pH - Units	SU	****		****	once/quarter*****	grab
MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE July 28, 2004.						
Outfall #003 - Emergency Overflow From Sump						
Flow	MGD	*		*	once/day when discharge occurs	24 hr. estimate
Total Suspended Solids	mg/L	100		30	once/day when discharge occurs	grab
Oil and Grease	mg/L	20		15	once/day when discharge occurs	grab
pH - Units	SU	****		****	once/day when discharge occurs	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE June 28, 2004. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.						

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

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OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #006 - New Ash Pond						
Flow	MGD	*		*	once/week	24 hr. total
Intake Total Suspended Solids***	mg/L	*		*	once/week	grab
Effluent Total Suspended Solids***	mg/L	*		*	once/week	grab
Net Total Suspended Solids***	mg/L	100		30	once/week	grab
Oil and Grease	mg/L	20		15	once/month	grab
pH - Units	SU	****		****	once/week	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE June 28, 2004.						
Sulfate (as SO_4^{-2})	mg/L	*		*	once/quarter*****	grab
MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE July 28, 2004.						
Whole Effluent Toxicity (WET) Test	% Survival	See Special Condition #1			once/year in January	grab
MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE October 28, 2004. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.						

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 and August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (continued)

* Monitoring requirement only.
** Sample once a weekday means: Monday, Tuesday, Wednesday, Thursday, and Friday.
*** Intake Non-Filterable Residue (Total Suspended Solids) values may be used to calculate "net" limitations. However, the permittee must continue to maintain the ash pond system for adequate retention time for settling. River solids present in intake water are "treated" in the ash pond system but treatment levels are dependent on concentration and types of river solids present in intake water.
**** pH is measured in pH units and is not to be averaged. The pH is limited to the range of 6.0-9.0 pH units.
***** Sample once per quarter in the months of February, May, August, and November.
****** A composite sample made up from a minimum of four grab samples collected within a 24-hour period with a minimum of two hours between each grab sample.

C. SPECIAL CONDITIONS

1. This permit may be reopened and modified, or alternatively revoked and reissued, to:
   (a) Comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a) (2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:
      (1) contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
      (2) controls any pollutant not limited in the permit.
   (b) Incorporate new or modified effluent limitations or other conditions, if the result of a waste load allocation study, toxicity test or other information indicates changes are necessary to assure compliance with Missouri's Water Quality Standards.
   (c) Incorporate new or modified effluent limitations or other conditions if, as the result of a watershed analysis, a Total Maximum Daily Load (TMDL) limitation is developed for the receiving waters which are currently included in Missouri's list of waters of the state not fully achieving the state's water quality standards, also called the 303(d) list.

   The permit as modified or reissued under this paragraph shall also contain any other requirements of the Clean Water Act then applicable.

2. Report as no-discharge when a discharge does not occur during the report period.

3. There shall be no discharge of polychlorinated biphenyl compounds.

4. Discharge of wastewater from this facility must not alone or in combination with other sources cause the receiving stream to violate the following:
   (a) Water temperatures and temperature differentials specified in Missouri Water Quality Standards shall be met.

5. Any pesticide discharge from any point source shall comply with the requirements of Federal Insecticide, Fungicide and Rodenticide Act, as amended (7 U.S.C. 136 et. seq.) and the use of such pesticides shall be in a manner consistent with its label.

6. Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day.

7. An upset provision, identical to the upset provision set forth at 40 CSR 122.41(n), is hereby incorporated in this permit.

8. Changes in Discharges of Toxic Substances

   The permittee shall notify the Director as soon as it knows or has reason to believe:
   (a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"
      (1) One hundred micrograms per liter (100 µg/L);
      (2) Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,5 dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
      (3) Five (5) times the maximum concentration value reported for the pollutant in the permit application;
      (4) The level established in Part A of the permit by the Director.
   (b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant, which was not reported in the permit application.

9. Permittee will cease discharge by connection to areawide wastewater treatment system within 90 days of notice of its availability.

C. SPECIAL CONDITIONS (continued)

10. General Criteria. The following water quality criteria shall be applicable to all waters of the state at all times including mixing zones. No water contaminant, by itself or in combination with other substances, shall prevent the waters of the state from meeting the following conditions:
    (a) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;
    (b) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;
    (c) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;
    (d) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;
    (e) There shall be no significant human health hazard from incidental contact with the water;
    (f) There shall be no acute toxicity to livestock or wildlife watering;
    (g) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community;
    (h) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.

11. Sludge and Biosolids Use For Domestic Wastewater Treatment Facilities
    (a) Permittee shall comply with the pollutant limitations, monitoring, reporting, and other requirements in accordance with the attached permit Standard Conditions.
    (b) If sludge is not removed by a contract hauler, permittee is authorized to land apply biosolids. Permit Standard Conditions, Part III shall apply to the land application of biosolids. Permittee shall notify the department at least 180 days prior to the planned removal of biosolids. The department may require submittal of a biosolids management plan for department review and approval as determined appropriate on a case-by-case basis.

12. Use or Disposal of Ash from Power Plants

    a. Disposal of ash is not authorized by this permit.
    b. This permit does not pertain to permits for disposal of ash or exemptions for beneficial uses of ash under the Missouri Solid Waste Management Law and regulations.
    c. This permit does not authorize off-site storage, use or disposal of ash in regard to water pollution control permits required under 10 CSR 20-6.015 and 10 CSR 20-6.200.
    d. Subsurface discharges from wastewater treatment ponds or ash ponds shall, at the property boundary, meet the effluent limitations for subsurface waters of the state under 10 CSR 20-7.015(7), with appropriate consideration of up-gradient water quality.

13. Permittee is exempt from Clean Water Act section 311 reporting for sulfuric acid and sodium hydroxide as per 40 CFR 117.12.

C. SPECIAL CONDITIONS (continued)

14. Whole Effluent Toxicity (WET) tests shall be conducted as follows:

WET test samples shall be collected during a period of time when biocide residuals will be present in the effluent.

At the Ameren, UE Sioux Plant, Whole Effluent Toxicity (WET) tests will be required for Outfall #001 only if biocides are used. The WET test will only be required in the first year if the initial test passes. If the WET test does not pass in the first year, the test must be run annually for the duration of the permit or until biocide use is discontinued.

An initial WET test will be required for Outfall #002 (Ash Pond) and #006 (New Ash Pond). The WET test will only be required in the first year if it passes at all effluent concentrations. If the WET test does fail at any concentration in the first year, the test must be run annually for the duration of the permit.

(PRIVATE) SUMMARY OF WET TESTING FOR THIS PERMIT				
OUTFALL	A.E.C. %	FREQUENCY	SAMPLE TYPE	MONTH
Outfall #001	66%	Annually	grab	January
Outfall #002, #006	10%	Annually	grab	January

(a) Test Schedule and Follow-Up Requirements

(1) Perform a single-dilution test in the months and at the frequency specified above. If the effluent passes the test, do not repeat the test until the next test period.
Submit test results along with complete copies of the test reports as received from the laboratory within 30 calendar days of availability to the WPCP, Water Quality Section, P.O. Box 176, Jefferson City, MO 65102.

(2) If the effluent fails the test, a multiple dilution test shall be performed within 30 calendar days , and biweekly thereafter, until one of the following conditions are met:

(a) THREE CONSECUTIVE MULTIPLE-DILUTION TESTS PASS. No further tests need to be performed until next regularly scheduled test period.
(b) A TOTAL OF THREE MULTIPLE-DILUTION TESTS FAIL.

(3) The permittee shall submit a summary of all test results for the test series along with complete copies of the test reports as received from the laboratory to the WPCP, Planning Section, P.O. Box 176, Jefferson City, MO 65102 within 14 calendar days of the third failed test.

(4) Additionally, the following shall apply upon failure of the third test: A toxicity identification evaluation (TIE) or toxicity reduction evaluation (TRE) is automatically triggered. The permitee shall contact WPCP, Planning Section to ascertain as to whether a TIE or TRE is appropriate . The permittee shall submit a plan for conducting a TIE or TRE to the Planning Section of the WPCP within 60 calendar days of the date of DNR's direction to perform either a TIE or TRE. This plan must be approved by DNR before the TIE or TRE is begun. A schedule for completing the TIE or TRE shall be established in the plan approval.

C. SPECIAL CONDITIONS (continued)

14. Whole Effluent Toxicity (WET) (continued)

(a) Test Schedule and Follow-Up Requirements (continued)

(5) Upon DNR's approval, the TIE/TRE schedule may be modified if toxicity is intermittent during the TIE/TRE investigations. A revised WET test schedule may be established by DNR for this period.

(6) If a previously completed TIE has clearly identified the cause of toxicity, additional TIEs will not be required as long as effluent characteristics remain essentially unchanged and the permittee is proceeding according to a DNR approved schedule to complete a TRE and reduce toxicity. Regularly scheduled WET testing as required in the permit, without the follow-up requirements, will be required during this period.

(7) All failing test results shall be reported to WPCP, Planning Section, P.O. Box 176, Jefferson City, MO 65102within 14 calendar days of the availability of the results.

(8) When WET test sampling is required to run over one DMR period, each DMR report shall contain information generated during the reporting period.

(9) Submit a concise summary of all test results with the annual report.

(b) PASS/FAIL procedure and effluent limitations:

(1) To pass a single-dilution test, mortality observed in the AEC test concentration shall not be significantly different (at the 95% confidence level; $p = 0.05$) than that observed in the upstream receiving-water control sample. The appropriate statistical tests of significance will be those outlined in the most current USEPA acute toxicity manual or those specified by the MDNR.

(2) To pass a multiple-dilution test:

(a) the computed percent effluent at the edge of the zone of initial dilution, Acceptable Effluent Concentration (AEC), must be less than three-tenths (0.3) of the LC_{50} concentration for the most sensitive of the test organisms; or,
(b) all dilutions equal to or greater than the AEC must be nontoxic. Failure of one multiple-dilution test is an effluent limit violation.

(c) Test Conditions

(1) Test Type: Acute Static non-renewal

(2) Test species: Ceriodaphnia dubia and Pimephales promelas (fathead minnow). Organisms used in WET testing shall come from cultures reared for the purpose of conducting toxicity tests and cultured in a manner consistent with the most current USEPA guidelines. All test animals shall be cultured as described in the most current edition of Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms.

(3) Test period: 48 hours at the "Acceptable Effluent Concentration" (AEC) specified above.

C. SPECIAL CONDITIONS (continued)

14. Whole Effluent Toxicity (WET) (continued)

(c) Test Conditions (continued)

(4) When dilutions are required, upstream receiving stream water shall be used as dilution water. If upstream water is unavailable or if mortality in the upstream water exceeds 10%, "reconstituted" water will be used as dilution water. Procedures for generating reconstituted water will be supplied by the MDNR upon request.

(5) Single-dilution tests will be run with:
(a) Effluent at the AEC concentration;
(b) 100% receiving-stream water (if available), collected upstream of the outfall at a point beyond any influence of the effluent; and
(c) reconstituted water.

(6) Multiple-dilution tests will be run with:
(a) 100%, 50%, 25%, 12.5%, and 6.25% effluent, unless the AEC is less than 25% effluent, in which case dilutions will be 4 times the AEC, two times the AEC, AEC, 1/2 AEC and 1/4 AEC;
(b) 100% receiving-stream water (if available), collected upstream of the outfall at a point beyond any influence of the effluent; and
(c) reconstituted water.

(7) If reconstituted-water control mortality for a test species exceeds 10%, the entire test will be rerun.

SUMMARY OF TEST METHODOLOGY FOR WHOLE-EFFLUENT TOXICITY TESTS

Whole-effluent-toxicity test required in NPDES permits shall use the following test conditions when performing single or multiple dilution methods. Any future changes in methodology will be supplied to the permittee by the Missouri Department of Natural Resources (MDNR). Unless more stringent methods are specified by the DNR,the procedures shall be consistent with the most current edition of Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms,

Test conditions for Ceriodaphnia dubia:

Test duration:	48 h
Temperature:	25 ± 1°C Temperatures shall not deviate by more than 3°C during the test.
Light Quality:	Ambient laboratory illumination
Photoperiod:	16 h light, 8 h dark
Size of test vessel:	30 mL (minimum)
Volume of test solution:	15 mL (minimum)
Age of test organisms:	<24 h old
No. of animals/test vessel:	5
No. of replicates/concentration:	4
No. of organisms/concentration:	20 (minimum)
Feeding regime:	None (feed prior to test)
Aeration:	None
Dilution water:	Upstream receiving water; if no upstream flow, synthetic water modified to reflect effluent hardness.
Endpoint:	Pass/Fail (Statistically significant Mortality when compared to upstream receiving water control or synthetic control if upstream water was not available at $p \leq 0.05$)
Test acceptability criterion:	90% or greater survival in controls

Test conditions for (Pimephales promelas):

Test duration:	48 h
Temperature:	25 ± 1°C Temperatures shall not deviate by more than 3°C during the test.
Light Quality:	Ambient laboratory illumination
Photoperiod:	16 h light/ 8 h dark
Size of test vessel:	250 mL (minimum)
Volume of test solution:	200 mL (minimum)
Age of test organisms:	1-14 days (all same age)
No. of animals/test vessel:	10
No. of replicates/concentration:	4 (minimum) single dilution method 2 (minimum) multiple dilution method
No. of organisms/concentration:	40 (minimum) single dilution method 20 (minimum) multiple dilution method
Feeding regime:	None (feed prior to test)
Aeration:	None, unless DO concentration falls below 4.0 mg/L; rate should not exceed 100 bubbles/min.
Dilution water:	Upstream receiving water; if no upstream flow, synthetic water modified to reflect effluent hardness.
Endpoint:	Pass/Fail (Statistically significant Mortality when compared to upstream receiving water control or synthetic control if upstream water was not available at $p \leq 0.05$)
Test Acceptability criterion:	90% or greater survival in controls

APPENDIX A

Document 6

Letter to USEPA from Ameren Missouri, March 2, 2011, Including Reitz & Jens Stability Report, November 16, 2010

March 2, 2011

Mr. Stephen Hoffman
US Environmental Protection Agency (5304P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Ameren Missouri
Sioux Power Station
Response to Dewberry & Davis Draft Coal Combustion Waste Impoundments
Round 7 – Dam Assessment Report

Dear Mr. Hoffman:

Below are Ameren Missouri's responses to the Dewberry & Davis draft dam safety assessment of the coal combustion waste (CCW) impoundments at the Sioux Power Station. The draft report was received by Ameren Missouri from the U.S. EPA on February 4, 2011. We have also enclosed a copy of our recently completed stability analysis of the Sioux CCW impoundments as requested by your consultant.

Excerpts of the Dewberry & Davis report are presented in bold faced type and our responses are provided in regular type.

INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMINDATIONS: In Summary the AmerenUE Sioux Fly Ash Dam is FAIR for continued safe and reliable operation, with acceptable performance expected under all required loading conditions, however minor deficiencies may exist that require remedial action or additional studies/investigations. The AmerenUE Sioux Bottom Ash Dam is FAIR for continued safe and reliable operation, with acceptable performance expected under all required loading conditions, however minor deficiencies may exist that require remedial action or additional studies/investigations. Results of a pending Embankment Stability Analysis currently being conducted for both embankments may affect the safety ratings assigned in this report.

Response: The subsurface investigation and stability analysis for the Sioux Power Station mentioned in the assessment has been completed and a copy of the report is enclosed with this letter. Based on these results, we request the condition rating be reevaluated prior to issuing the final report.

1.1.5. Conclusions Regarding the Field Observations: A small seep in the northeast corner of the Bottom Ash Pond dam was observed 75' from the toe of the embankment with clear water exiting the area. AmerenUE is monitoring the situation on a weekly basis.

Response: Ameren Missouri will continue to monitor the seepage for clarity and volume fluctuations during the weekly inspections. Ameren has initiated a project to install an inverted filter along the seepage area and plans to implement this project in 2011.

1.2.2. Recommendations Regarding the Hydrologic/Hydraulic Safety: It is recommended that AmerenUE conduct an updated hydrologic/hydraulic safety study to reflect current conditions.

Response: A hydrologic/hydraulic analysis was completed by Reitz & Jens, Inc. August 27, 2007 and a copy of this report was provided to the EPA consultant. According to the Reitz & Jens, Inc. hydrologic/hydraulic study, there is sufficient capacity to store water from the 100 year event if normal pool elevations of 440 feet in the Fly Ash Pond and 440.5 feet in the Bottom Ash Pond are maintained.

1.2.5. Recommendations Regarding the Field Observations: It is also recommended that removal of the woody vegetation along the bottom ash pond, southeast side, should continue if the filled area is planned to be removed and used as an embankment in the future.

Response: Ameren is currently using the filled area as a parking/staging lot and has no future plans to remove the filled area.

1.2.6. Recommendations Regarding the Maintenance and Methods of Operation: Maintain existing embankment slopes to keep vegetation controlled and to allow for easy visual inspection of the dams.

Response: Ameren will continue a regular maintenance program to control vegetation.

5.2.3 Downstream/Outside Slope and Toe: Figure 5.2.3-1 shows one of the eroded areas near the northwest corner of the embankment.

Response: Since the time of the inspection this area has been regraded and repaired utilizing geotextile and riprap for the entire length of this face to minimize future erosion. This project was completed in January, 2011.

5.3.3 Downstream/Outside Slope and Toe: A small seep was observed (Fig. 5.3.3-2) in the northwestern corner of the pond embankment, approximately 75' from the toe of the embankment.

Response: See 1.1.5 Above.

5.4.3 Emergency Spillway: No emergency spillway is present for either the Fly Ash Pond or Bottom Ash Pond.

Response: The emergency isolation gate installed in the bottom ash pond water control structure also serves as an emergency spillway for the bottom as pond. In an emergency situation this gate structure will be overtopped and route flow through the outlet pipe and prevent overtopping on the perimeter embankment.

Errors and Omissions:

Section 2.4.2

We no longer have any stop logs installed in the bottom ash pond water control structure; it has been replaced with a new emergency gate isolation system for flow control. An emergency isolation gate was added to the bottom ash pond discharge structure. This also applies to 4.2.2 as well.

Figure 5.3.3-2

The small seep is in the northeastern portion of the pond not the "northwestern."

Section 5.4.1

The corrugated skimmer is incorrectly described as "the outfall structure". A section of the corrugated was removed to allow excess volume to flow from the bottom ash pond. The majority of the inflow comes from the 24" HPDE Pipe that has a suction bell below the water surface. The boom curtain was added to contain oils and debris from being discharged from the bottom ash structure.

Figure 5.4.1-1

This figure should be titled emergency isolation gate system for flow control.

Section 8.2

The section should read; Dam Safety Program for Ameren UE Non-Hydroelectric Facilities vs. Cailities

General:

Ameren UE is now Ameren Missouri

Sections 2.2, 2.4.1, & 5.2.2 The liner that was installed in the fly ash pond is not 60mm (millimeters) thick. It should be 60 mils.

Business Confidentiality Claim

We request the Draft Dam Safety Assessment Report for the Sioux Power Station prepared by Dewberry & Davis, as well as our responses to this report remain confidential. We also request the attached Sioux Ash Pond Dam Stability Analysis Report be kept confidential. This request is made in accordance with the procedures described in 40 CFR, Part 2, Subpart B.

When initially submitting support documents to Dewberry & Davis for preparation of their report we also designated the following materials as confidential:

- Plans of the embankment
- EIP
- Dam Safety Program for AmerenUE Non-Hydro Facilities
- Reitz & Jens, Inc. August 27, 2007 Phase I Report
- Subsurface Investigation, Evaluation and Recommendation with Planning and General Design , Feb. 1981
- Soil Borings and Pile Data dated April 2, 1979
- 2008 and 2009 Inspection Reports
- Weekly Inspection Reports

If you need further information, please feel free to contact me at 314-554-2388.

Sincerely,

Paul R. Pike
Environmental Science Executive
Environmental Services
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Enclosures

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November 16, 2010

CONFIDENTIAL

Mr. Matt Frerking
Managing Supervisor – Dam Safety
Ameren Missouri
3700 South Lindberg, MC F-604
Sunset Hills, Missouri 63127

RE: Ash Pond Dam Stability Analysis
Sioux Power Station

Dear Mr. Frerking:

This report presents our findings and recommendations from the geotechnical field investigations, laboratory testing, land survey, and slope stability analyses of the dams impounding the ash ponds at the Sioux Power Station. The investigation, testing and analyses was done in general accordance with our proposal dated January 29, 2010, and Ameren Missouri's request for proposal dated December 9, 2009. The purpose of this project is to evaluate the stability of the ash pond dams and conduct the necessary land surveys, subsurface explorations, and laboratory testing to define the critical section at each location. The slope stability analysis conducted was for the load cases required by the Missouri Department of Natural Resources (MDNR). The results of the slope stability analysis were compared to the required safety factors for the type and assumed hazard classification of each dam.

In 2007, Reitz & Jens (RJ) completed the Phase I: AmerenUE Dam Inventory and Inspection Program project. This project was a preliminary study and consisted of determining the existing condition and classification status of the dams at Rush Island, Meramec, Labadie and Sioux Power Stations and developing a site specific inspection program at each power station. The project involved field inspections, surveys, site reconnaissance, research of current registration requirements, and pertinent computations. Site specific recommendations for future inspections were developed which include inspection templates, frequency of monitoring and maintenance recommendations. The study reported that the height of the Sioux bottom ash pond dam was approximately 27 feet and fly ash pond dam was approximately 22.3 feet, and that the dams did not fall under the current MDNR regulation that requires all dams 35 feet or more in height to be regulated. The report also found no dwellings downstream of the dams and if regulation were necessary the dams would be categorized within Environmental Site Class III. The MDNR dam safety regulations have not changed since the 2007 report.

SURVEY

A land survey was conducted to determine the elevation profile along the crest of the dam. The extents of the survey were chosen to include the areas with the greatest elevation difference between the crest and the downstream toe and the segments impounding water or unconsolidated sediment. Cross-

sections were also surveyed at multiple locations at each plant to determine the slope heights and geometry. Zahner and Associates, Inc. conducted the survey, as a subcontractor to RJ. At the Sioux Power Station an elevation survey of the crest over approximately 2,300 lineal feet of the bottom ash pond and 2,100 feet of the fly ash pond was conducted. Elevation profile measurements were taken at 100 foot intervals. The extents of the elevation profile are shown in Figure 1 and a plot of the measured elevations is presented in Appendix B. A total of six cross-sections were surveyed, two on the fly ash pond and four on the bottom ash pond. Plots of the cross-sections are shown in Appendix A. From the cross-section surveys, the approximate height of the Sioux bottom ash pond dam is 28 feet and the height of the fly ash pond dam is 21 feet. The dam height surveyed during this project is in close agreement with that found during the Phase I: AmerenUE Dam Inventory and Inspection Program project.

GEOTECHNICAL FIELD INVESTIGATION AND LAB TESTING

Geotechnical field investigations were conducted using rotary drilling and cone penetrometer test (CPT) soundings. The quantity of borings and soundings, and the approximate locations at the power station are shown in Figure 1. The boring locations were selected by RJ based on previous experience at these locations, to fill in gaps were there was no subsurface data, slope geometry and to provide soil profiles representative of as much of the embankment as possible. The elevations of the ground surface at the boring locations were measured by Zahner and Associates, Inc. The borings were made by Terra Drill, Inc. of Dupo, Illinois, as a subcontractor to Reitz & Jens. The borings were advanced through the soil using 4.25-in. I.D. hollow-stem augers. Mud rotary drilling was necessary in all 3 of the auger drilling locations. Holes were backfilled with cement grout, which was tremmied from the bottom to the top.

The CPT soundings were also made by Terra Drill, Inc. using a Geo-probe rig, under a subcontract with Reitz & Jens. The cone penetrometer consists of a 1.5-inch diameter, 100 MPa capacity, electronic piezocone (CPTu), which records tip pressure, sleeve friction and porewater pressure as it is hydraulically pushed into the ground. The testing was carried out according to ASTM D5778. The holes were backfilled the same day with Bentonite pellets.

The field investigation was done under the direction of a Reitz & Jens' geological engineer or geotechnical technician, who determined the sampling intervals and the termination depths, operated the CPT equipment, and logged the borings. The boring logs for the Sioux Power Station are presented in Figures 2-1 to 2-2. Logs of the CPT soundings are presented in Figures 3-1 to 3-6. The keys and notes for the boring logs and CPT soundings are shown in Figures 2-0 and 3-0, in that order.

Samples of subsurface materials were obtained using rotary drilling methods at about 2.5-foot intervals for the first 10 feet, at 5-foot intervals below 10 feet. Two types of samplers were used: 1) a hydraulically pushed, 3-in. O.D., thin-walled Shelby tube sampler (ASTM D-1587); and 2) a 2-in. O.D., split-spoon sampler driven by an automatic hammer in conjunction with a Standard Penetration Test (ASTM D-1586). Published tests have shown that the blow counts from a Standard Penetration Test (SPT) using an automatic hammer are about 75% of the blow counts obtained using a manual 140-lbs. drop hammer, rope and cathead. Manual SPT hammers have been used to develop correlations between SPTs and soil properties, therefore, the blow counts, or N-values, from an automatic hammer should be increased by about one-third in order to use such correlations. The uncorrected blow counts are shown on the boring logs. The disturbed split-spoon samples obtained were visually classified in the field and sealed in glass jars to prevent loss of moisture, for later testing in the laboratory. The relatively

undisturbed Shelby tube samples were sealed in the tubes and were extruded from the tubes immediately prior to testing in the lab.

All of the recovered samples were visually described in our laboratory in general accordance with the Unified Soil Classification System and the Standard Test Method for Classification, Description, and Identification of Soils (ASTM D-2487 and D-2488). Index tests were also performed and included: water content and dry unit weight tests (ASTM D-2216). The results of these index tests appear on the individual boring logs. Unconsolidated undrained (UU) triaxial compression tests (ASTM D2850) and consolidated undrained (CU) triaxial compression tests (ASTM D-4767) with pore pressure measurement were performed on selected Shelby tube samples of the fine grained samples, to obtain better measurements of the *in situ* total and effective shear strength properties. The results of the UU and CU triaxial shear strength tests are presented with the boring logs in Figures 2-3 to 2-6.

The field data from the CPT soundings were analyzed in the office using the program CPT-pro, Ver. 5.49 by Geosoft. The program automatically applies corrections for depth, and post/pre-data collection baseline readings. These corrected field data are plotted in the CPT logs, which are field tip resistance (q_c), sleeve friction (f_s) and pore water pressure (u2). Soil type was determined based upon the Robertson (1986) method[1]. Undrained shear strength (s_u) was calculated for cohesive materials based upon the Lunne (1997) method[2]. Equivalent Standard Penetration Test (SPT) N_{60} values were calculated using procedures recommended by Robertson (1986)[1]. The equivalent N_{60} values were used to verify the computed internal friction angle (ϕ) in sands and s_u in fine-grain soils. The estimate of ϕ in coarse soils was based upon the measured q_c values using Bowles (1996).[3] The computed parameters N_{60}, s_u and ϕ are also plotted in the CPT logs.

PIEZOMETER INSTALLATION AND MONITORING

Temporary piezometers were installed to help define the line of seepage through the dam. Two piezometers were installed at Sioux. The piezometers were located as close to the downstream crest as possible, with the tips located in the lower most embankment fill above the native soils. The locations of the piezometers are shown in Figure 1, and descriptions of the tip elevation are noted in the boring logs. PZ-1 was located near the northwest corner of the bottom ash pond. P-8 (PZ) was located along the west side of the bottom ash pond, in an area where seepage has been observed during prior inspections of the embankment by Ameren personnel.

PZ-1 was constructed using 1-inch inside diameter Schedule 40 PVC pipe and P-8 was constructed with ¾" Schedule 40 PVC pipe. The smaller diameter pipe was necessary in P-8 because it was installed in a CPT sounding hole. The piezometers had a 0.010-inch factory machine-slotted screen and were capped with a flush mount well protector. The bottom 10 feet of the piezometers were screened and backfilled with filter sand.

---

[1] Robertson, P.K., et al. (1986), "Use of Piezometer Cone Data," *Proceedings of the ASCE Specialty Conference In Situ 86: Use of In Situ Tests in Geotechnical Engineering*, ASCE.
[2] Lunne, T., Robertson, P.K. and Powell, J.J.M. (1997). *Cone Penetration Testing in Geotechnical Practice.* Published by Blackie Academic * Professional.
[3] Bowles, Joseph E. (1996). *Foundation Analysis and Design.* 5th ed., McGraw-Hill, page 180.

Readings were obtained from the piezometers and compared to the pool elevation. A table containing the piezometer readings is shown below. The temporary piezometers were removed after several readings were obtained and the holes were grouted close with cement grout.

Sioux Power Station

Date	Piezometer	Reading	Groundwater Elevation (ft)	Ground Surface Elevation (ft)	Tip Elevation (ft)	Pond Elevation (ft)
6/28/2010	PZ-1	15.7	427.3	443.0	423.5	436.2
8/2/2010	PZ-1	17.4	425.6	443.0	423.5	-
8/30/2010	PZ-1	19.8	423.2	443.0	423.5	435.5
10/8/2010	PZ-1	20.8	422.3	443.0	423.5	434.0
8/30/2010	P-8	15.7	428.7	444.4	426.5	435.5
10/8/2010	P-8	17.1	427.3	444.4	426.5	434.0

SIOUX POWER STATION

The Sioux Power Station is located in northeastern St. Charles County, Missouri in the floodplain of the Mississippi and Missouri Rivers. The plant is east of the City of Portage Des Sioux and west of the City of West Alton. The Mississippi River is adjacent to the plant and to the north at approximately river mile 210 above the confluence with the Ohio River. Poeling Lake and Brick House Slough of the Mississippi River lie to the west and north. The floodplain is continuous to the east and extends approximately 2 miles south to the Missouri River. The Sioux watershed is impounded by two dams to form the Bottom and Fly Ash Ponds. The Sioux Plant dams are single stage industrial dams. The Bottom Ash Pond dam impounds an area of approximately 47-acres. The Fly Ash Pond dam impounds an area of approximately 60-acres. These areas were estimated from aerial photos. The length of the perimeter of the dam measured along the crest for the Bottom Ash and Fly Ash Ponds is 6,600-lineal-feet (lf) and 7,675-lf respectively.

The Fly Ash dam was constructed in the 1990's. The upstream slopes of the Fly Ash dam are constructed of compacted earth fill at 3 (H) to 1 (V) and are lined with a 60 millimeter high-density polyethylene liner (HDPE). The upstream slopes were constructed from the top and over the upstream slope of an existing railroad and roadway embankment. The existing slopes of the railroad and roadway embankments are typically 2 (H) to 1 (V) and form the downstream slopes. A short section at the northwest corner of the dam was constructed with new downstream slopes at 3 (H) to 1 (V).

The Bottom Ash dam was constructed in the 1960's and consists of compacted earth fill but at 2 (H) to 1 (V). The Bottom Ash Pond is unlined. No data was provided regarding the initial geotechnical design assumptions or construction criteria used for the dams. The original design bottom elevation of the Bottom Ash Pond was elevation 400-feet.

Fly Ash Pond

The top of the fly ash pond dam was surveyed along the extents shown in Figure 1. The crest elevation ranged from 441.2 to 444.3-feet. A plot of the elevation profile along the crest of the dam is also shown in Appendix B. Two cross-sections were also surveyed, and showed upstream slopes of approximately 3 (H) to 1 (V) and downstream slopes of approximately 2 (H) to 1 (V) and 2.5 (H) to 1 (V). The

approximate crown width varies but is generally between 30 and 40 feet. Drawings showing the measured cross-sections are presented in Appendix A.

CPT soundings were conducted at 2 locations along the fly ash pond. Both locations were in the crest of the dam and were advanced to a depth of 50 feet. A third sounding was planned at the toe, but due to floodwaters and soft saturated soils it was not conducted. Soundings through the crest revealed the embankment fill to be 1 to 3 foot thick alternating layers of sand, silt and clay to a depth of approximately 15 to 16 feet. For modeling purposes we modeled the embankment as an upper and lower fill. We assumed the ϕ of the upper and lower fill to be 25° and 28°, in that order.

Firm to stiff clay soil was then encountered beneath the embankment fill to depths of 22 to 26 feet. A CU test on similar material obtained from a location near the bottom ash pond yielded an effective cohesion of 350 psf and a ϕ of 23°. Underlying the clay was silty sand and sand. Based on the CPT soundings, the ϕ of the silty sand and sand ranged from 27.5 to 30°. These soils generally made up the top 10 to 15 feet of the foundation. The foundation soils became increasingly coarse and dense with depth. The CPT soundings were terminated in sand or gravely sand that has an estimated ϕ of 35°.

Bottom Ash Pond

An elevation profile was run on the crest of the bottom ash pond along the extents shown in Figure 1. The elevation ranged from 442.6 to 445.5-feet. The complete elevation profile is presented in Appendix B. Three cross-sections were surveyed by the professional land surveying sub-consultant and one additional section was surveyed by RJ. These cross-sections are also shown in Appendix B, and show that the upstream and downstream slopes are approximately 2 (H) to 1 (V). The crown width varies from approximately 13 to 20 feet.

Two rotary borings and two CPT soundings were conducted in the crest and two CPT soundings were conducted at the toe of the bottom ash pond. The location of these borings is shown in Figure 1. The embankment fill consists of very soft to stiff clay, silt and sand layers ranging in thickness from 0.5 to 4 feet in thickness. A CU test on an undisturbed sample obtained in the upper 15 feet showed a ϕ of 26° and effective cohesion of 100 pcf. The soil strengths measured using the CPT soundings were in general agreement with the test data obtained from the CU test.

The top 10 to 12 feet of the foundation soil is high plastic clay or silty clay. The clay is firm to stiff. An undisturbed sample was also obtained in the foundation soils at a depth of approximately 5 feet beneath the embankment fill. A CU test was run on a specimen taken from this sample and resulted in a ϕ of 23.5° and effective cohesion of 350 psf. Beneath the clay, sand and silty sand was encountered to the termination depth. The sand was poorly graded and generally medium dense. Based on the CPT soundings, the ϕ of the sand and silty sand ranged from 30 to 35°.

Slope Stability Analysis Results

The stability of the fly ash pond slopes was analyzed using cross-section 5, and the steady-seepage and seismic load cases. The steady-seepage case was analyzed at normal and maximum pool, but it was assumed that no seepage occurs through the HDPE liner. The normal pool elevation was assumed at 438.0 feet. The maximum pool was assumed at approximately elevation 440.8, or the overtopping

elevation. For the seismic load case a horizontal acceleration of 0.05 g or 0.25 of the probable maximum acceleration (PMA) was added to the steady state seepage model. The seismic load was taken from 10 CSR 22-3 for St. Charles County (Zone E) and for an environmental site class III dam.

For the bottom ash pond, the slope stability of cross-section 1 was analyzed using the same load cases used for the fly ash pond. For the steady seepage case, piezometric data collected during this project was used to model the line of seepage and was assumed representative of the normal pool. The normal pool elevation was assumed at elevation 435.0 feet. The maximum pool was assumed at elevation 442.4. For the maximum pool, a theoretical line of seepage was created and adjusted slightly to mimic the seepage at normal pool.

The factor of safety for each load case and each section analyzed is summarized in the following table. Graphical depictions of the slope stability models and the analysis results are shown in Appendix B. For Class III Industrial dams the calculated factor of safety exceeds the minimum required by the MDNR for the fly ash pond. For the bottom ash pond the factor of safety for steady seepage at normal pool is less than that required by the MDNR. For the maximum pool and seismic load cases the minimum factor of safety required is met. The factors of safety presented in the table are representative of deep failure surfaces that would significantly impair the ability of the dam to function as intended. When shallow failure surfaces are considered the factor of safety rapidly degrades for all load cases, especially along the west side of the bottom ash pond.

Sioux Power Station

Load Case	Required Factor of Safety	Factor of Safety	
		Fly Ash Pond	Bottom Ash Pond
Full Reservior, Steady Seepage	1.5	1.9	1.4
Maximum Reservior, Steady Seepage	1.3	1.8	1.3
Earthquake, steady seepage, full reservior	1.0	1.6	1.2

Seepage Evaluation

During the initial stages of this project RJ was made aware of a seepage area near the toe of the embankment close to the northeast corner of the bottom ash pond. The scope of this project was expanded to analyze and monitor the seepage, and provide recommendations for the remediation of this area. The seepage area consisted of one area with concentrated or "piping" type flow. In the same area, several "pin" type seeps were also observed flowing at the same time as the larger seep.

The seepage area with concentrated flow was observed making sediment and a sample of the sediment yielded was obtained. The grain size of the sediment was quantified and is provided in Figures 2-7 to 2-10. A sandbag ring was constructed around the area with concentrated flow to provide estimates of flow rate, qualitatively estimate the sediment yield and slow the transport of sediment. The flow rate was measured with a 90° v-notched weir at 3 stages of the sandbag construction, or three different ponding levels above the seep. The bottom ash pond level was at approximately elevation 434 feet (roughly 1 to 2 feet lower than normal because of a plant outage) or 15 feet the elevation of the seep. The flow measurements are approximate due to seepage through and under the sandbags, but are a reasonable

estimate. A flow of approximately 5 gallons per minute (gpm) was measured. The flow at the normal pond level is probably higher, but was not measured. The table below presents the field measurements and the calculated flow rate.

Ponding Above Seep (ft)	Head Across Weir (ft)	Flow Rate (gpm)
0.50	0.12	5.05
1.50	0.10	3.56
2.25	0.08	2.4*

*Estimated Value

The sandbag ring and weir were left in place after the flow measurements were concluded. Qualitative monitoring of sediment yield was conducted with several visits to the site. A small cone of sediment has accumulated around the "piping" type flow. Observations were partially obstructed by biological growth within the sandbag ring, the continued biological growth has prevented any additional monitoring.

In light of the seep, an additional section was surveyed by RJ and analyzed. A piezometer was installed near the downstream crest of the crown near this section (P-8). This section or the North cross-section is shown in Appendix A, and was analyzed for the steady seepage and seismic load cases. Using the piezometric data and the estimated head at the toe from flow monitoring, the line of seepage was estimated. The factor of safety for the steady seepage case was approximately 1.3 and for the seismic case was 1.1. The factor of safety for the steady seepage load case is below the minimum required by the MDNR.

Observations of the seep show that the sediment yield is intermittent. The history of the seepage area is unknown. We recommend constructing an inverted filter over the bank of the seepage area to help stop the migration of fines from within the embankment. The details of the filter are presented in Appendix C. The filter should generally consist of a two foot thick base layer of coarse sand above the existing ground surface. The coarse sand should be overlain with a two foot intermediate layer consisting of gravel. Four feet of rip rap is recommended at the surface of the filter to protect against wave and current erosion. The recommended gradations for the coarse sand, and gravel and rip rap are presented in Appendix C. A sketch of the approximate location, limits of the filter and a typical cross-section of the filter are also presented in this appendix.

A densification program is also recommended to remediate any potential voids caused by the transport of fines. The extent of the piping or severity of the problem has not be determined. If the densification program is not conducted, monitoring of the seepage area, and the area near the toe and slopes on the north side of the bottom ash pond should be conducted regularly. Recently bottom ash has been added to the upstream slope to increase the thickness of the dam opposite the seepage area. We recommend installing a permanent piezometer at the downstream crest in this area to determine if the additional fill is increasing the seepage path through the embankment and lowering the line of seepage.

CONCLUSIONS

Slope stability analysis conducted on cross-section 5 for the fly ash pond showed the factor of safety for steady seepage and earthquake load cases meet the MDNR minimum required factor of safety for Class III industrial dams. For the bottom ash pond, the steady seepage load case at normal pool did not meet the minimum required by the MDNR for Class III industrial dams for cross-section 1 and the north cross-section. The factor of safety for steady seepage at the maximum pool and the seismic load case met the minimum required by MDNR. The slope stability analysis considered critical surfaces which would significantly impact the performance of the dam. For shallow failure surfaces the factor of safety is much lower, especially on the west side of the bottom ash pond. Although shallow failures may not immediately impact the performance of the dam, if left unchecked these problems can propagate or unravel the slope and become a significant hindrance to the operation of the pond and require considerable effort to repair. The embankment slopes should be maintained and inspected regularly so that shallow failures can be identified and repaired in a timely fashion.

The pond level and resulting line of seepage through the dam has a significant impact on the stability of the bottom ash pond slopes. We recommend keeping the pond level at or below the assumed normal pool elevation. For sustained pond levels above the assumed normal pool elevation piezometers should be installed to monitor the line of seepage through the embankment.

An inverted filter should be constructed over the downstream bank were seepage has been observed. The details of the inverted filter are provided in Appendix C. Monitoring of the seepage area should be continued. A densification program is recommended to remediate any potential voids caused by the transport of fines.

Please let us know if you have any questions regarding this report or any aspects of the project. We appreciate this opportunity to continue our working relationship with Ameren Missouri.

Sincerely,
REITZ & JENS, Inc.

Donald S. Eskridge, P.E.
Principal

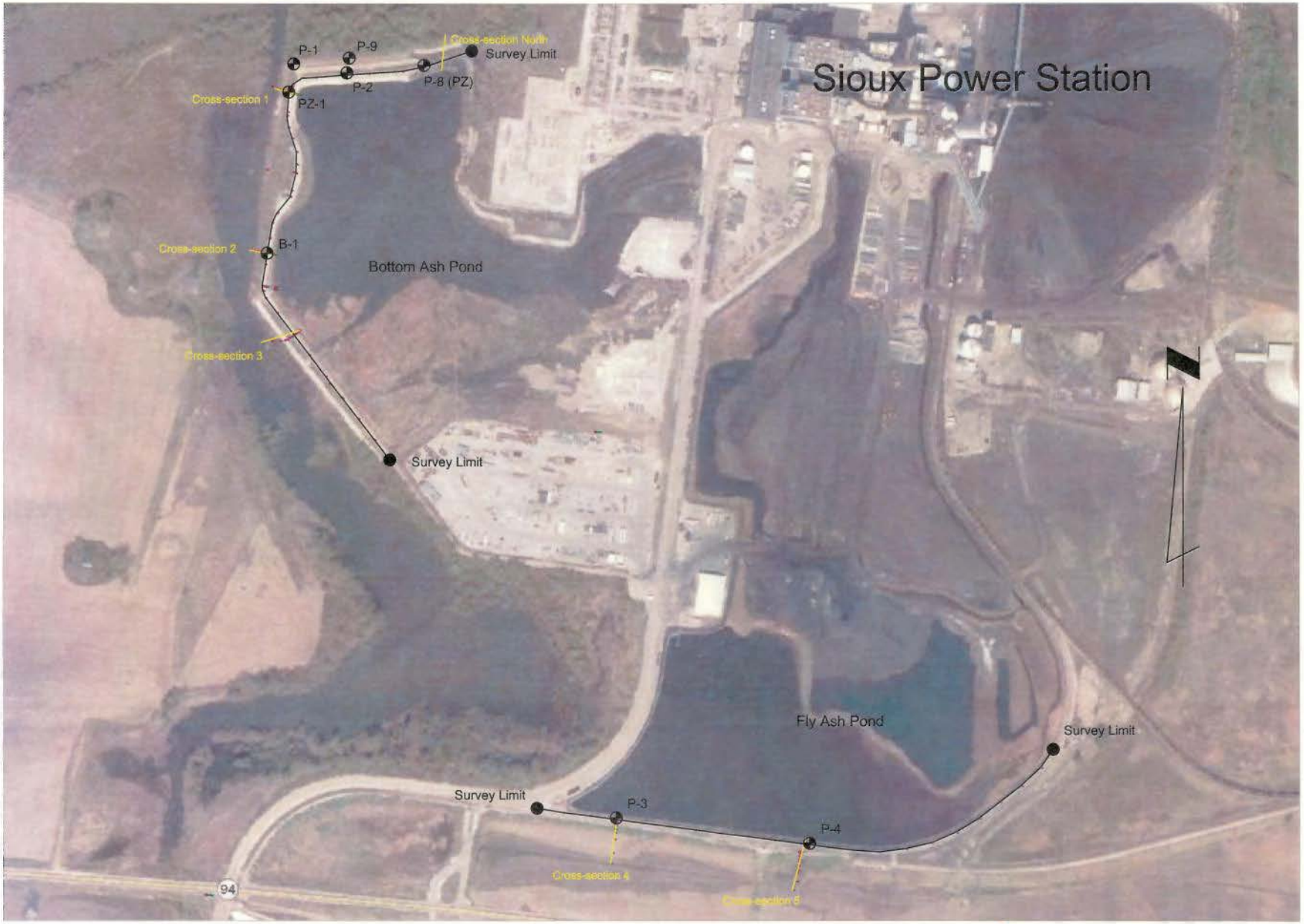
Jeff Bertel, P.E.
Project Engineer

The following figures are attached and complete this report:

Figure 1	Boring Location Map
Figure 2-0	Key to Boring Logs
Figures 2-1 to 2-2	Logs of Borings
Figures 2-3 to 2-6	Graphs of CU and UU tests
Figures 2-7 to 2-10	Particle Size Distribution Reports

Figure 3-0	Key to CPT Soundings
Figure 3-1 to 3-6	Logs of CPT Soundings
Appendix A	Cross-section
Appendix B	Elevation Profile
	Graphical Depictions of Slope Stability Models
Appendix C	Inverted Filter Details

Copies submitted: 5



Elevation Profile Survey Limits
Locations of Cross-section and Borings

REITZ & JENS, INC.
CONSULTING ENGINEERS

Figure 1

KEY TO BORING LOGS

Symbol Description

KEY TO SOIL SYMBOLS


Crushed Limestone


Miscellaneous FILL


High plastic CLAY (CH)


Poorly-graded SAND (SP)


Low plastic Silty CLAY (CL)

MISCELLANEOUS SYMBOLS


Water table during drilling


Boring continues


Moisture content (%)


N-value from Standard Penetration Test, ASTM D-1586 (blows/ft)


Shear strength from Pocket Penetrometer (tsf)

SOIL SAMPLERS


2-in. O.D. Split-Spoon


3-in. O.D. Shelby Tube

Notes:

1. Details of the drilling and sampling program are presented in the general introduction of the report

2. Stratification lines shown on the log represent approximate soil boundaries; actual changes in strata may be gradual or occur between samples.

Figure 2-0

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG PZ-1

Ash Pond Stability
Sioux Power Plant
CLIENT: **Ameren Missouri**

LOCATION: N 1121510.79 E 877737.340
ELEVATION: 443.0 DATUM: NAVD88
DATE DRILLED: 06-12-10

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						8" CRUSHED LIMESTONE, 1/2" minus rock		
					100	FILL, consisting of compacted layers and laminations of high plastic clay, silty clay, silt, sand and mixtures of all, stiff, moist	2-5-6	19.2
	440					Becoming firm		
					56		2-2-2	24.6
5								
					44		2-2-2	23.8
	435							
					40		98.2	23.7
10						PZ-1, screened interval from 10'6" to 20'6"		
	430							
					67	Becoming very moist and very soft	0-0-1	28.7
15		▽						
					83		91.3	30.3
	425							
					83	Becoming firm	1-2-3	28.0
20						Began mud rotary drilling at 20'		
	420							
					67	CLAY (CH), gray, firm, high plastic, with silty clay, trace limonite and fine roots	2-3-3	25.7
25								
	415							
					83	Without silty clay	1-2-2	29.2
30								

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Terra Drill
METHOD: 3.75" ID HSA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%): 86.3
LOGGED BY: C. Cook

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 16 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ___ FEET

File: 2010012488

Figure 2-1 Sheet 1 of 2

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG PZ-1

Ash Pond Stability

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0	410							
35					100	SAND (SP), brownish-tan, fine to medium grain, loose	0-2-6	29.1
	405					Becoming medium dense		
40					67		6-9-9	
	400							
45					94		2-5-6	
	395							
50					67	Becoming gray with fine gravel lenses	7-11-20	
	390					Boring terminated at 50'-0" in sand		
55								
	385							
60								
	380							
65								
	375							
70								

SHEAR STRENGTH, tsf

△ QU/2 ■ PP □ SV ◇ TV

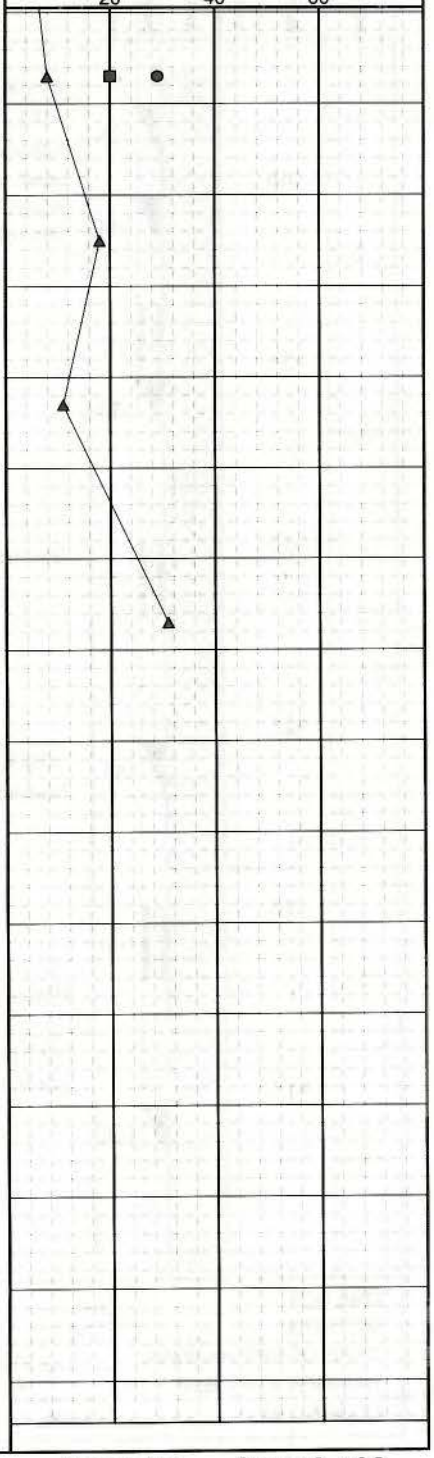
1 2 3

STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)

● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)

PL LL

20 40 60



File: 2010012488

Figure 2-1 Sheet 2 of 2

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-1

Ash Pond Stability
Sioux Power Plant
CLIENT: **Ameren Missouri**

LOCATION: N 1122114.98 E 877818.565
ELEVATION: 443.0 DATUM: NAVD88
DATE DRILLED: 06-12-10

DEPTH (FEET)	ELEVATION	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0				8" CRUSHED LIMESTONE, 1/2" minus rock		
			28	FILL, consisting of compacted layers and laminations of silty clay, high plastic clay, sand, silt and mixtures of all, trace lignite, stiff, moist	4-3-4	20.1
	440					
			44	Becoming firm	2-2-4	28.9
5						
			67		103.6	22.8
	435					
			83		2-2-2	24.3
10						
	430			Becoming very moist		
			92		87.3	29.3
15						
	425					
			83	Silty CLAY (CL), gray, firm, trace lignite and limonite	1-3-2	24.8
20						
	420					
			100		86.8	29.1
25				Began mud rotary drilling at 25'		
				SAND (SP), brownish-tan, fine to medium grain, medium dense		
	415					
			100		7-11-9	
30						

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Terra
METHOD: 4.75" HSA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%): 86.3
LOGGED BY: C. Cook

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 22 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT _____ FEET AFTER ____ HOURS
AT _____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ___ FEET

File: 2010012488

Figure 2-2 Sheet 1 of 2

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-1

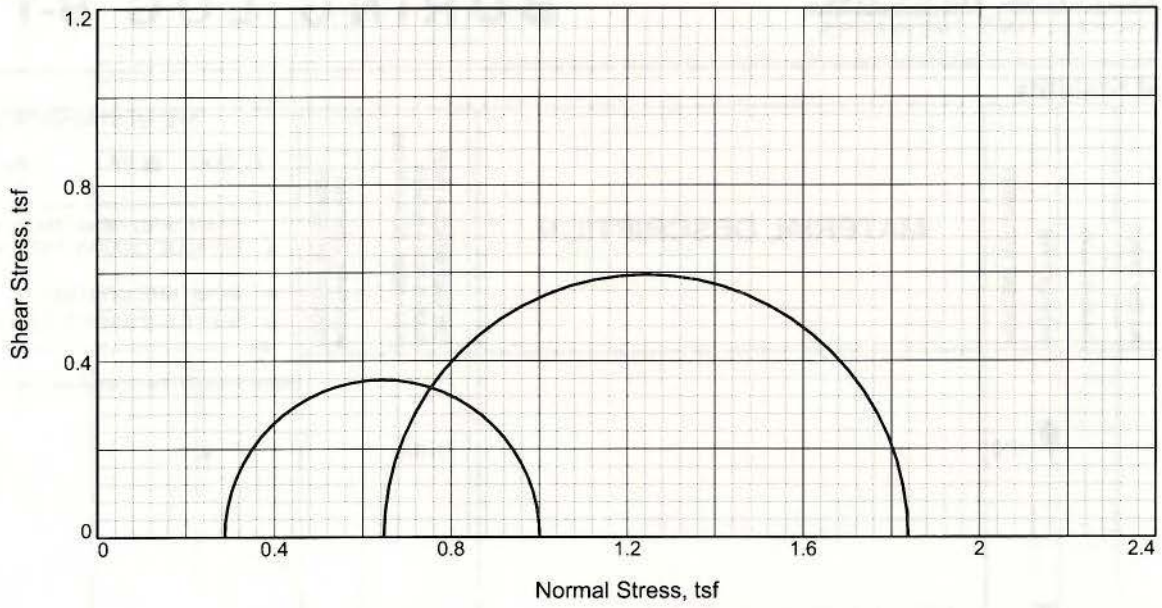
Ash Pond Stability

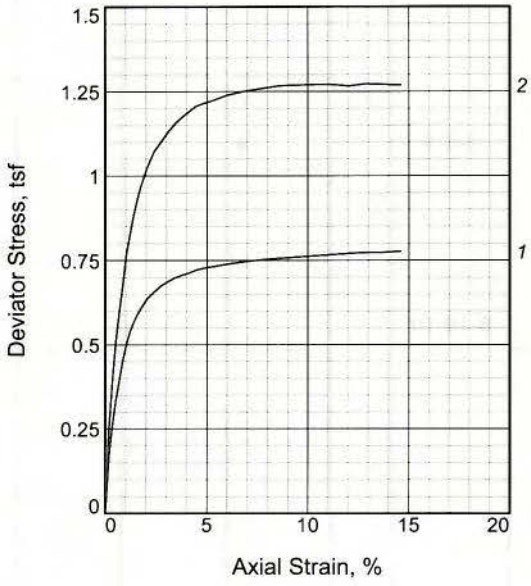
DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
35	410				100		7-9-9	
40	405				100	With clay laminations in sample	5-5-8	
45	400				33	Becoming fine to coarse grain	8-8-9	
50	395				100	Becoming gray	6-10-10	
55	390					Boring terminated at 50'-0" in sand		
60	385							
65	380							
70	375							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

File: 2010012488

Figure 2-2 Sheet 2 of 2





Sample No.		1	2
Initial	Water Content,	28.8	31.7
	Dry Density, pcf	93.3	89.2
	Saturation,	97.3	97.0
	Void Ratio	0.7936	0.8765
	Diameter, in.	2.85	2.85
	Height, in.	5.82	5.82
At Test	Water Content,	28.8	31.7
	Dry Density, pcf	93.3	89.2
	Saturation,	97.3	97.0
	Void Ratio	0.7936	0.8765
	Diameter, in.	2.85	2.85
	Height, in.	5.82	5.82
Strain rate, %/min.		0.80	0.80
Back Pressure, tsf		0.00	0.00
Cell Pressure, tsf		0.29	0.65
Fail. Stress, tsf		0.71	1.19
Ult. Stress, tsf		0.78	1.27
σ_1 Failure, tsf		1.00	1.84
σ_3 Failure, tsf		0.29	0.65

Type of Test: Unconsolidated Undrained

Sample Type: Shelby Tube

Description: Clay, silty clay, clayey silt, and clayey sand FILL (CH-CL-SC), grey, with lignite and limonite, sand lenses and some

Assumed Specific Gravity= 2.68

Remarks:

Client: Ameren Missouri

Project: Ash Pond Stability

Source of Sample: PZ-1 **Depth:** 16

Sample Number: ST-6

Proj. No.: 2010012488 **Date:** 6/14/10

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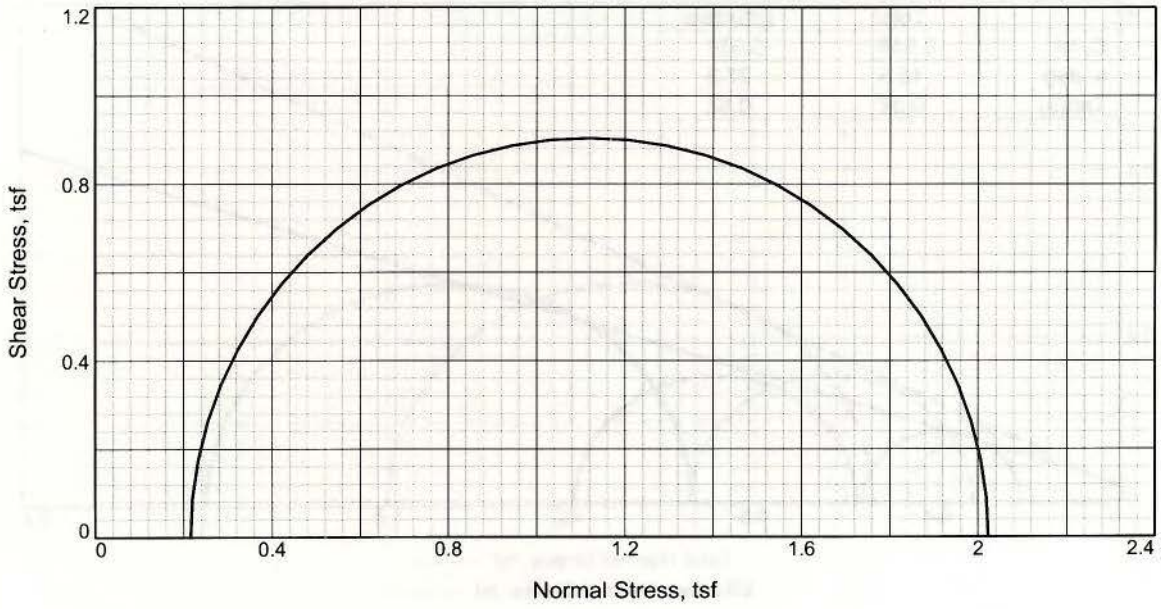
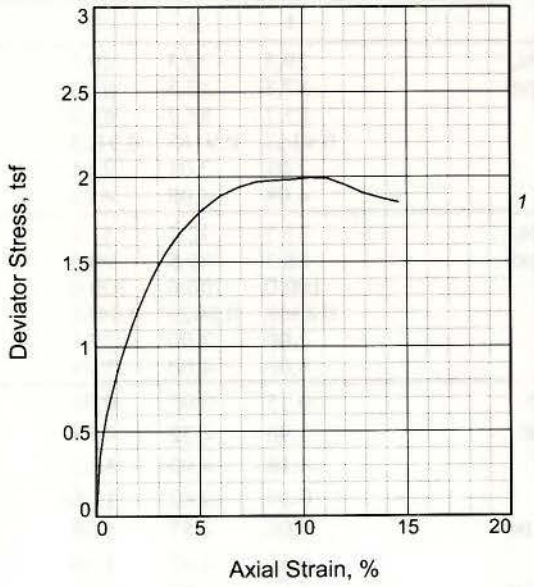
CONSULTING ENGINEERS

Figure 2-3

Tested By: K. Kocher **Checked By:** J. Bertel





Sample No.		1
Initial	Water Content,	22.8
	Dry Density, pcf	103.6
	Saturation,	99.6
	Void Ratio	0.6146
	Diameter, in.	2.85
	Height, in.	5.82
At Test	Water Content,	22.8
	Dry Density, pcf	103.6
	Saturation,	99.6
	Void Ratio	0.6146
	Diameter, in.	2.85
	Height, in.	5.82
Strain rate, %/min.		0.80
Back Pressure, tsf		0.00
Cell Pressure, tsf		0.22
Fail. Stress, tsf		1.81
Ult. Stress, tsf		2.00
σ_1 Failure, tsf		2.02
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained
Sample Type: Shelby Tube
Description: Clay, silty clay, clayey silt, and sandly silty clay FILL (CH-CL-ML), grey, with lignite and limonite
Assumed Specific Gravity= 2.68
Remarks:

Client: Ameren Missouri

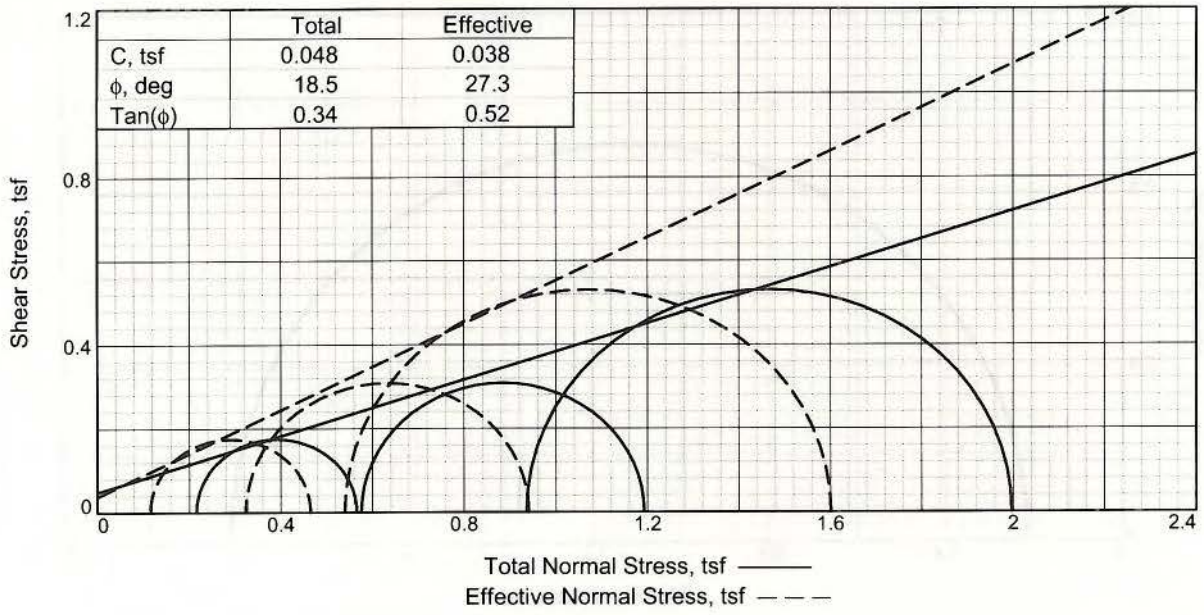
Project: Ash Pond Stability

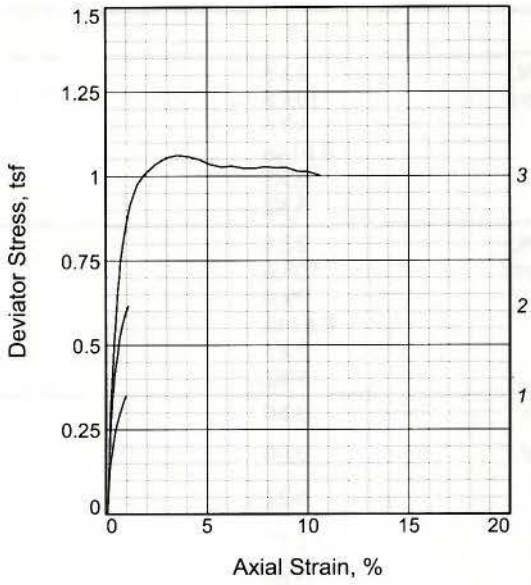
Source of Sample: B-1 **Depth:** 6.5
Sample Number: ST-3
Proj. No.: 2010012488 **Date:** 6/14/10

REITZ & JENS, INC.
CONSULTING ENGINEERS

Figure 2-4

Tested By: K. Kocher **Checked By:** J. Bertel





Sample No.		1	2	3
Initial	Water Content,	29.3	29.3	29.3
	Dry Density, pcf	87.3	87.3	87.3
	Saturation,	85.7	85.7	85.7
	Void Ratio	0.9163	0.9163	0.9163
	Diameter, in.	2.01	2.01	2.01
	Height, in.	4.08	4.08	4.08
At Test	Water Content,	33.1	32.2	31.7
	Dry Density, pcf	88.7	89.8	90.5
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.8868	0.8629	0.8488
	Diameter, in.	2.00	2.00	2.01
	Height, in.	4.06	4.00	3.95
Strain rate, %/min.		0.15	0.05	0.03
Back Pressure, tsf		3.96	4.32	4.68
Cell Pressure, tsf		4.18	4.90	5.62
Fail. Stress, tsf		0.35	0.62	1.06
Total Pore Pr., tsf		4.06	4.57	5.08
Ult. Stress, tsf		0.35	0.62	1.06
Total Pore Pr., tsf		4.06	4.57	5.08
$\bar{\sigma}_1$ Failure, tsf		0.47	0.94	1.60
$\bar{\sigma}_3$ Failure, tsf		0.12	0.32	0.54

Type of Test:
CU with Pore Pressures

Sample Type: Shelby Tube

Description: Silty clay, clayey silt, and clay FILL, grey, with sandy silt lenses, lignite, and limonite

Assumed Specific Gravity= 2.68

Remarks:

Client: Ameren Missouri

Project: Ash Pond Stability

Source of Sample: B-1 **Depth:** 13

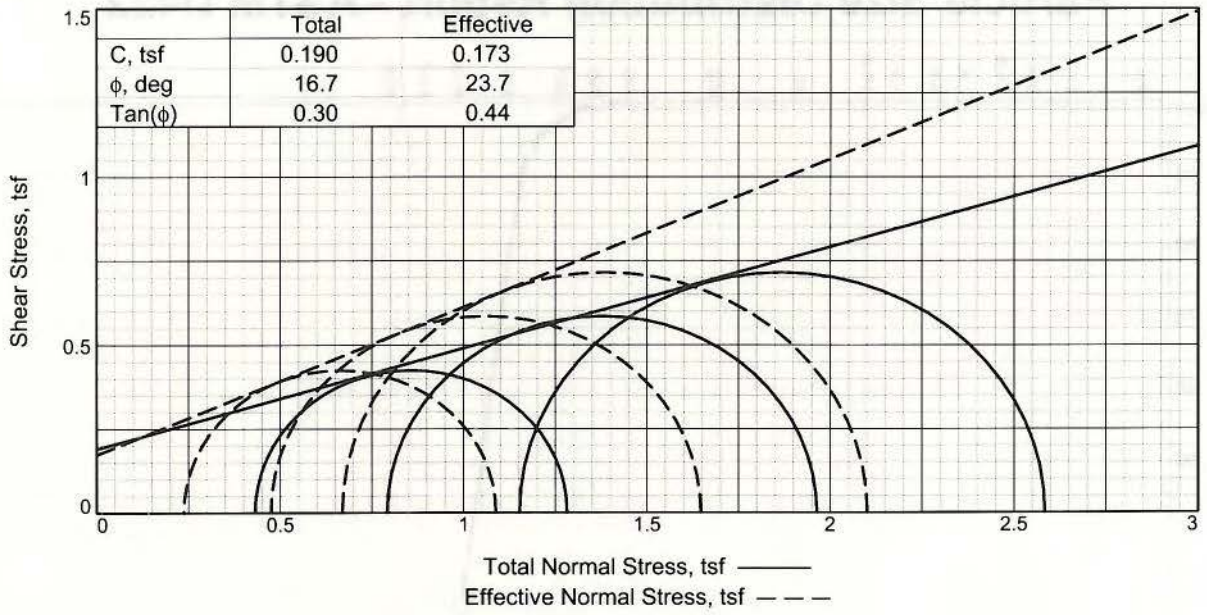
Sample Number: ST-5

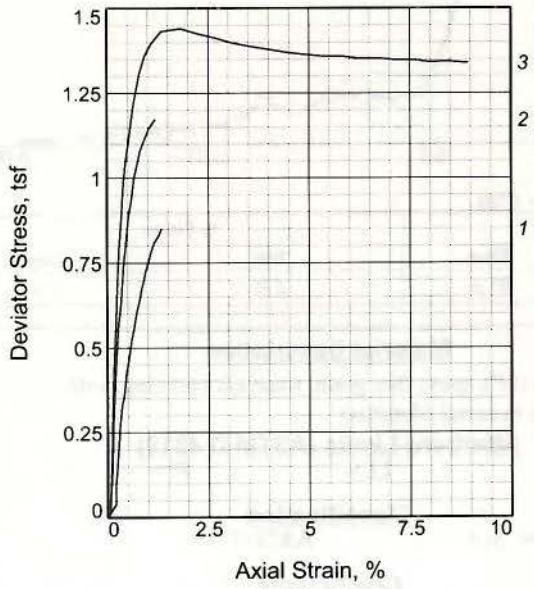
Proj. No.: 2010012488 **Date:** 6/14/2010

REITZ & JENS, INC.
CONSULTING ENGINEERS

Figure 2-5

Tested By: K. Kocher **Checked By:** J. Bertel





Sample No.		1	2	3
Initial	Water Content,	29.1	29.1	29.1
	Dry Density, pcf	86.8	86.8	86.8
	Saturation,	84.2	84.2	84.2
	Void Ratio	0.9280	0.9280	0.9280
	Diameter, in.	2.02	2.02	2.02
	Height, in.	5.00	5.00	5.00
At Test	Water Content,	33.3	33.0	32.9
	Dry Density, pcf	88.4	88.7	89.0
	Saturation,	100.0	100.0	100.0
	Void Ratio	0.8923	0.8854	0.8807
	Diameter, in.	2.01	2.02	2.03
	Height, in.	4.97	4.90	4.84
Strain rate, %/min.		0.50	0.50	0.50
Back Pressure, tsf		3.96	4.32	5.04
Cell Pressure, tsf		4.39	5.11	6.19
Fail. Stress, tsf		0.85	1.17	1.43
Total Pore Pr., tsf		4.15	4.64	5.52
Ult. Stress, tsf		0.85	1.17	1.43
Total Pore Pr., tsf		4.15	4.64	5.52
$\bar{\sigma}_1$ Failure, tsf		1.09	1.65	2.10
$\bar{\sigma}_3$ Failure, tsf		0.24	0.48	0.67

Type of Test: CU with Pore Pressures

Sample Type: Shelby Tube

Description: Silty CLAY (CL), grey-brown, with lignite and limonite

LL= 45

Assumed Specific Gravity= 2.68

Remarks:

Client: Ameren Missouri

Project: Ash Pond Stability

Source of Sample: B-1 **Depth:** 23

Sample Number: ST-7

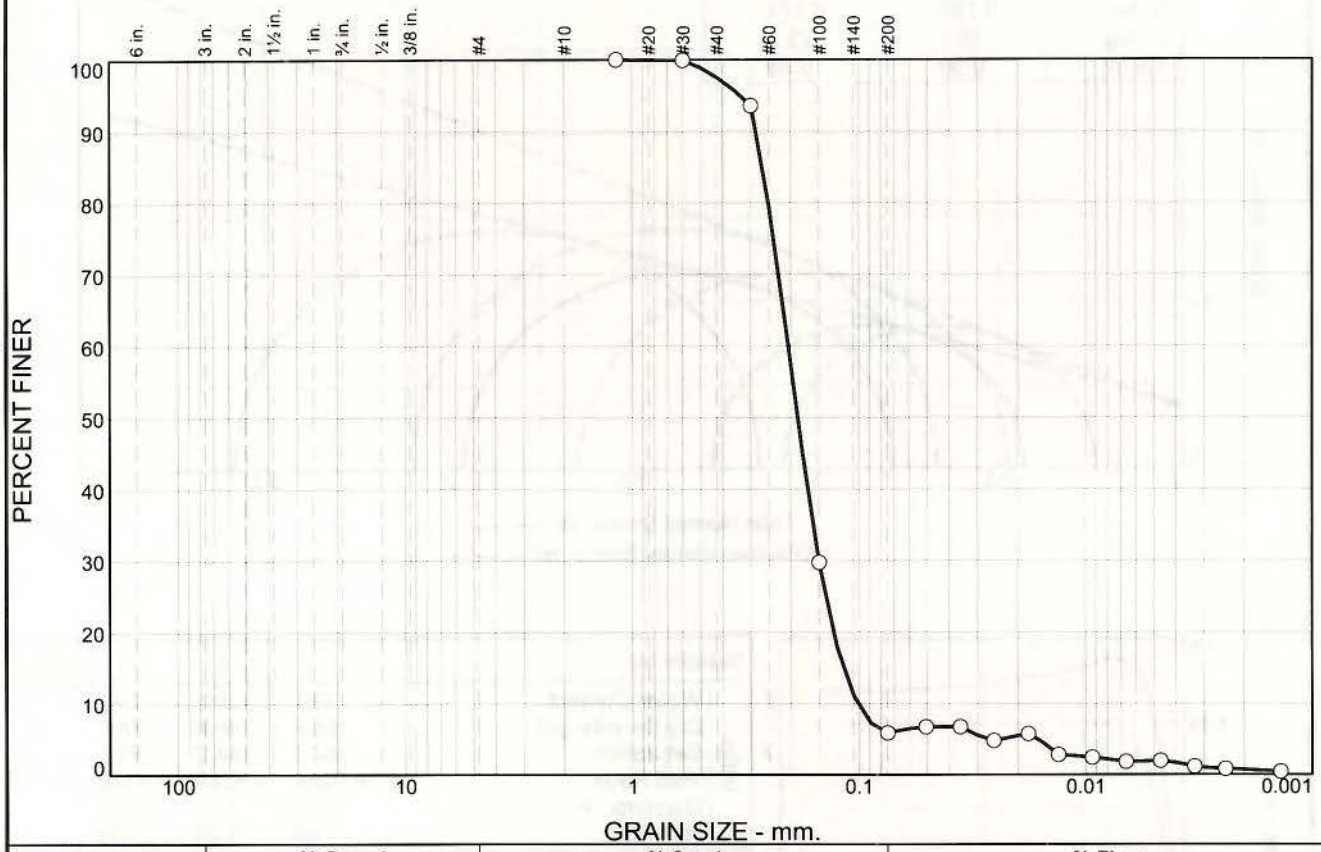
Proj. No.: 2010012488 **Date:** 6-14-10

REITZ & JENS, INC.
CONSULTING ENGINEERS

Figure 2-6

Tested By: K. Kocher **Checked By:** J. Fouse

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	2.5	91.6	4.0	1.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.9		
#50	93.6		
#100	29.8		
#200	5.9		

* (no specification provided)

Material Description

SAND (SP), grey, fine grain, trace silt and clay, with organic material (detritus)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= SM AASHTO=

Coefficients

D_{85}= 0.2658 D_{60}= 0.2051 D_{50}= 0.1863
D_{30}= 0.1504 D_{15}= 0.1174 D_{10}= 0.1015
C_u= 2.02 C_c= 1.09

Date Tested: 9/13-15/10 **Tested By:** J. Crose, K. Kocher

Remarks

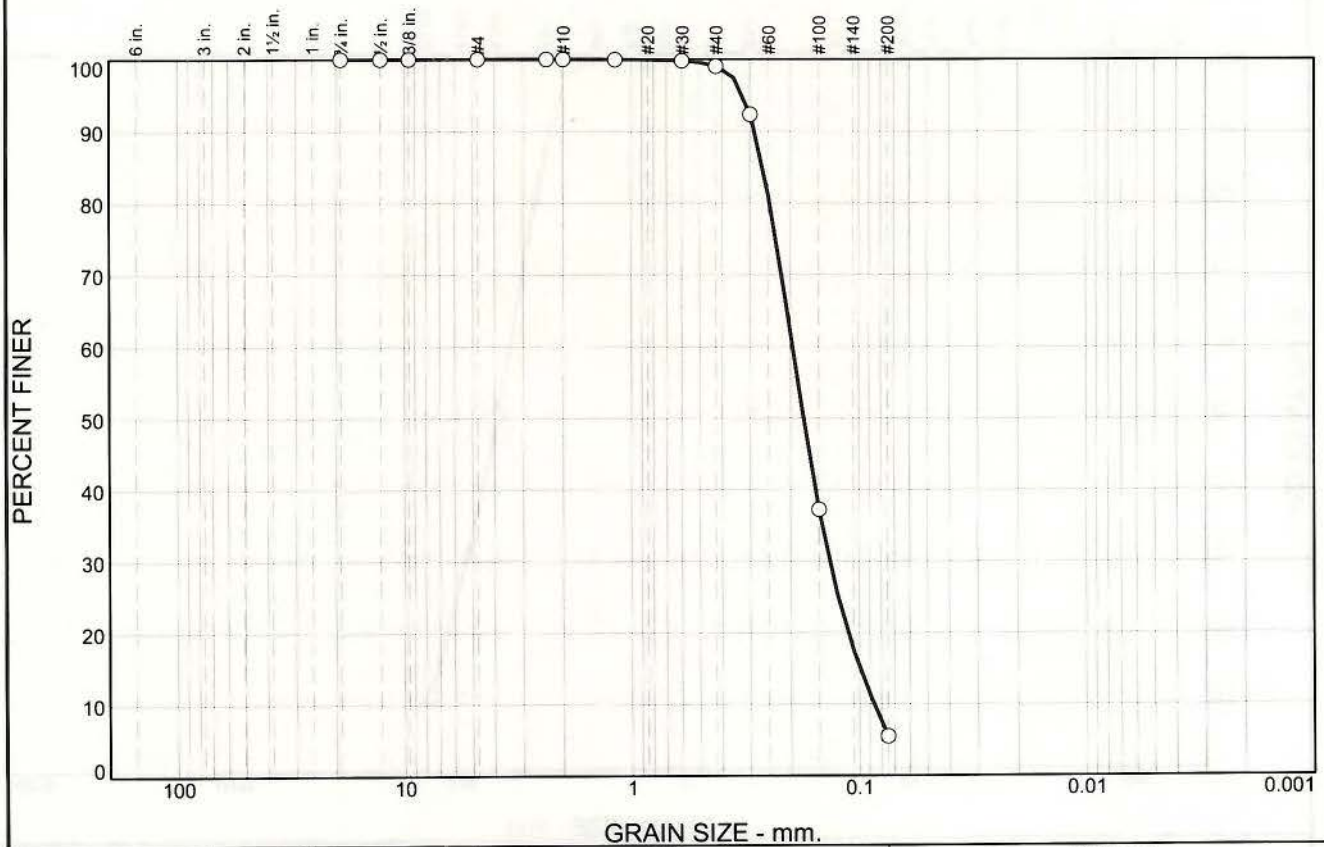
Sample No.: Sample #1 **Source of Sample:** Sand Boil Location **Date Sampled:** 9/9/10
Location: **Elev./Depth:** Surface
Checked By: D. Eskridge **Title:** Project Manager

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage

Project No: 2010012488 **Figure** 2-7

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.0	93.5	5.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.0		
#50	92.3		
#100	37.2		
#200	5.5		

* (no specification provided)

Material Description

SAND (SP), grey, fine grain, trace silt and clay, with organic material (detritus)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 0.2639 D_{60}= 0.1955 D_{50}= 0.1750
D_{30}= 0.1350 D_{15}= 0.0994 D_{10}= 0.0863
C_u= 2.26 C_c= 1.08

Date Tested: 9/13/10 **Tested By:** J. Crose

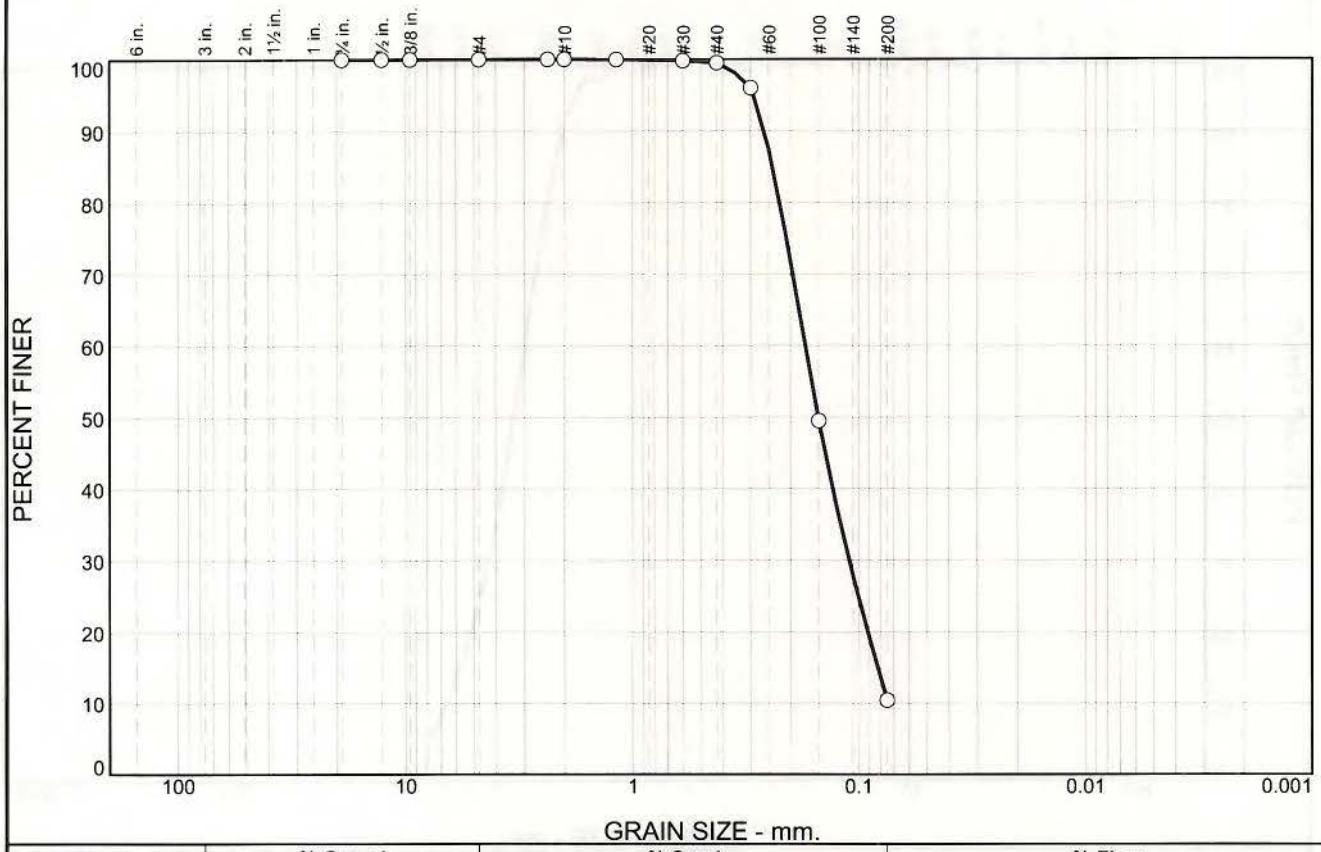
Remarks

Sample No.: Sample #1 **Source of Sample:** Sand Boil Location **Date Sampled:** 9/9/10
Location: **Elev./Depth:** Surface
Checked By: D. Eskridge **Title:** Project Manager

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage
Project No: 2010012488 **Figure** 2-8

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	89.1	10.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#10	100.0		
#16	100.0		
#30	99.8		
#40	99.5		
#50	96.0		
#100	49.6		
#200	10.4		

* (no specification provided)

Material Description

SAND (SP-SM), grey, fine grain, with silt, clay, and organic material (detritus)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 0.2400 D_{60}= 0.1720 D_{50}= 0.1509
D_{30}= 0.1102 D_{15}= 0.0824 D_{10}=
C_u= C_c=

Date Tested: 9/13/10 **Tested By:** J. Crose

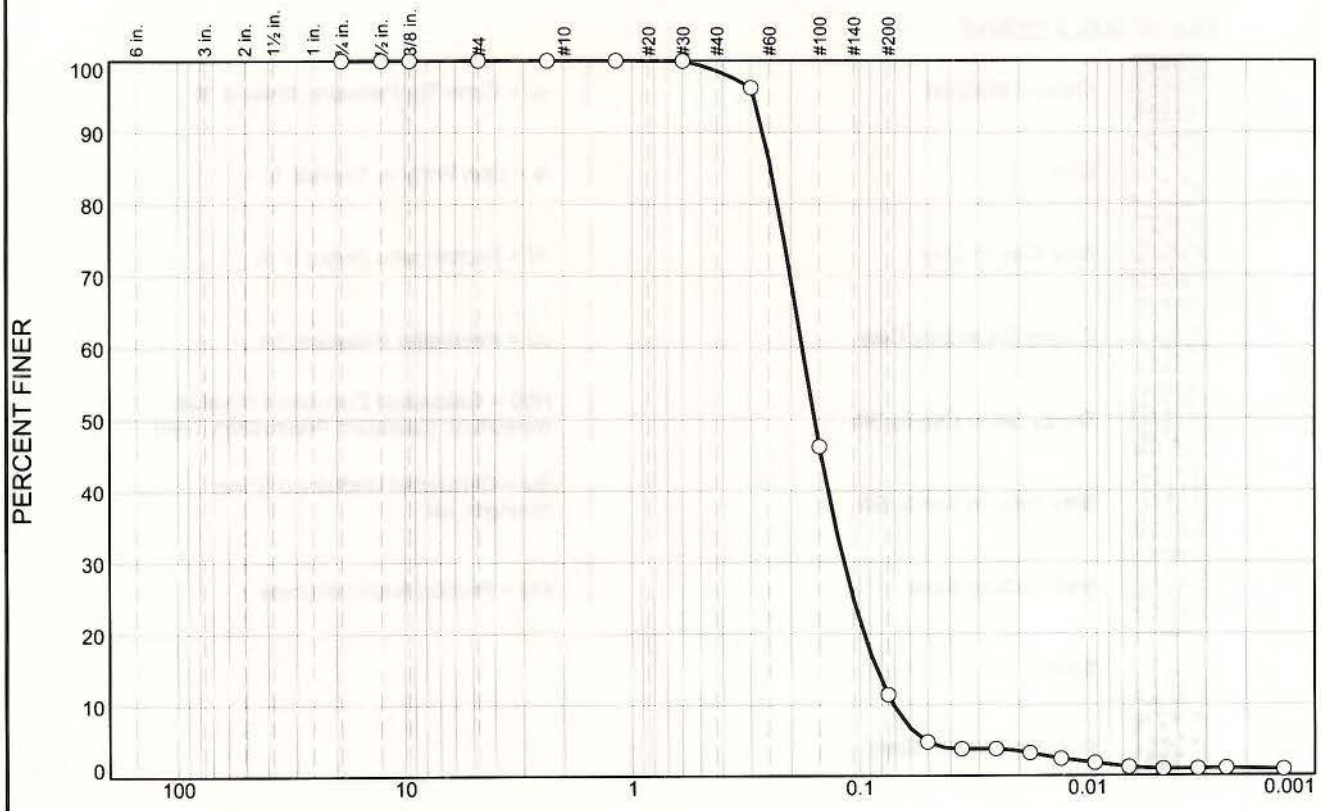
Remarks

Sample No.: Sample #2 **Source of Sample:** Sand Boil Location **Date Sampled:** 9/9/10
Location: **Elev./Depth:** Surface
Checked By: D. Eskridge **Title:** Project Engineer

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage
Project No: 2010012488 **Figure** 2-9

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.4	87.1	10.5	1.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	96.2		
#100	46.2		
#200	11.5		

* (no specification provided)

Material Description

SAND (SP-SM), grey, fine grain, with silt, clay, and organic material (detritus)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 0.2456 D_{60}= 0.1786 D_{50}= 0.1577
D_{30}= 0.1172 D_{15}= 0.0841 D_{10}= 0.0708
C_u= 2.52 C_c= 1.09

Date Tested: 9/13-15/10 **Tested By:** J. Crose, K. Kocher

Remarks

Sample No.: Sample #2 **Source of Sample:** Sand Boil Location **Date Sampled:** 9/9/10
Location: **Elev./Depth:** Surface
Checked By: D. Eskridge **Title:** Project Manager

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage
Project No: 2010012488 **Figure** 2-10

LEGEND

Symbol Description

KEY TO SOIL SYMBOLS

Organic Material

Clay

Silty Clay to Clay

Clayey Silt to Silty Clay

Sandy Silt to Clayey Silt

Silty Sand to Sandy Silt

Sand to Silty Sand

Sand

Gravelly Sand to Sand

qc = Cone Tip Pressure, tons/sq. ft.

fs = Skin Friction, tons/sq. ft.

Rf = Friction ratio (fs/qc) in %

u2 = Porewater Pressure, psi

N60 = Calculated Equivalent N-value, blows/foot, (Standard Penetration Test)

Su = Calculated Undrained Shear Strength, ksf

Phi = Friction Angle, degrees

Notes:

1. Details of the drilling and sampling program are presented in the general introduction of the report.
2. Stratification lines shown on the log represent approximate soil boundaries; actual changes in strata may be gradual.

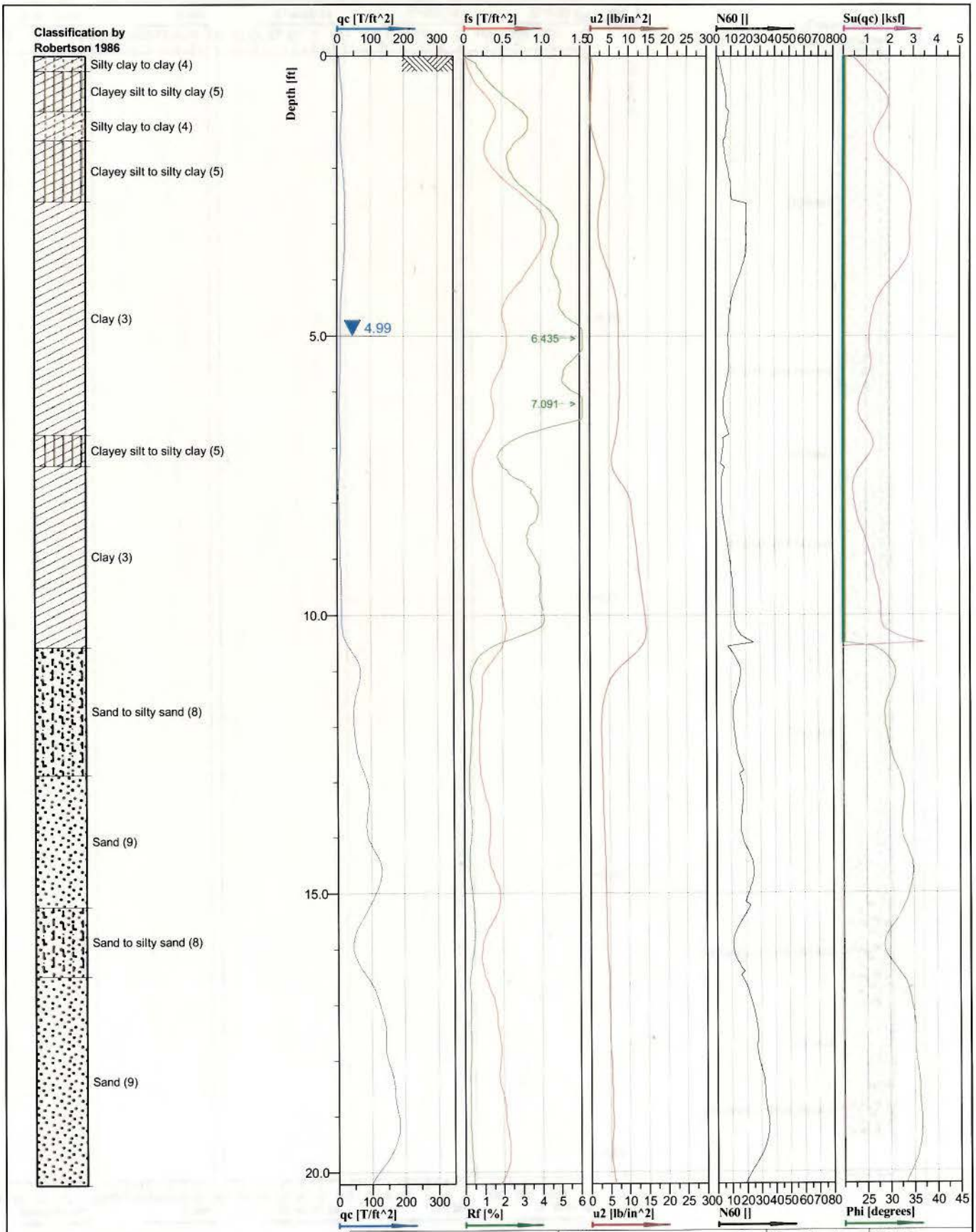
---

[1] Robertson et al. (1986) *Use of piezometer cone data.* Proceedings of the ASCE Specialty Conference: In Situ 86: Use of In Situ Tests in Geotechnical Engineering. ASCE 1986

[2] Lunne, T. Robertson, P.K. and Powell, J.J.M. (1997) Cone Penetration Testing in Geotechnical Practice, Published by Blackie Academic & Professional.

[3] Bowles, Joseph E. (1996) Foundation Analysis and Design. McGraw-Hill. 5th ed. Page 180.

Figure 3-0

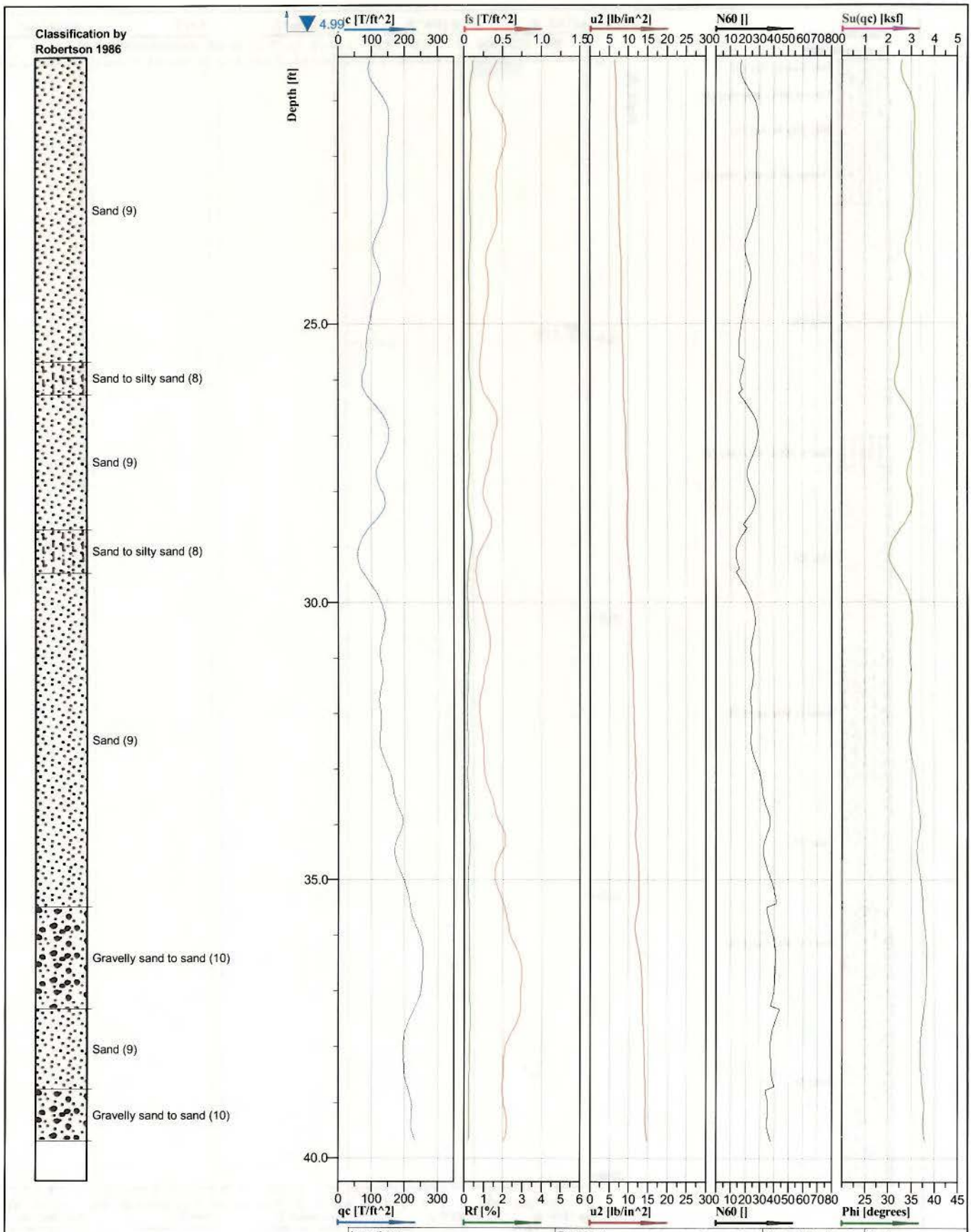


Location: Sioux Power Plant	Position: X: 877872.87 ft, Y: 1122198.49 ft	Ground level: 425.98	Test no: P-1
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 28
Project: 2010 Ash Pond Stability Analysis		Page: 1/2	Fig: 3-1
		File: p-1.cpd	

REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

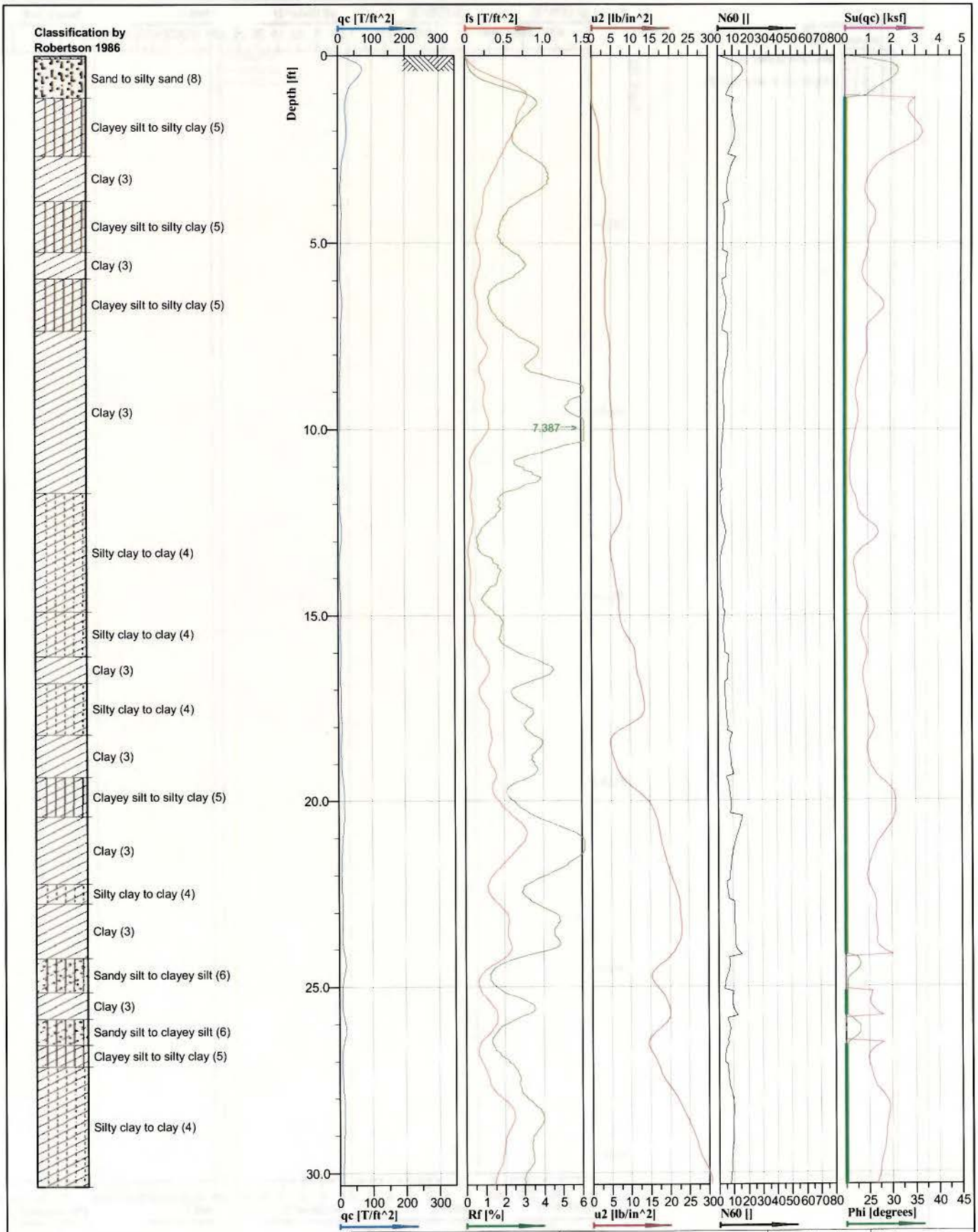


REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Sioux Power Plant	Position: X: 877872.87 ft, Y: 1122198.49 ft	Ground level: 425.98	Test no: P-1
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 28
Project: 2010 Ash Pond Stability Analysis		Page: 2/2	Fig: 3-1
		File: p-1.cpd	

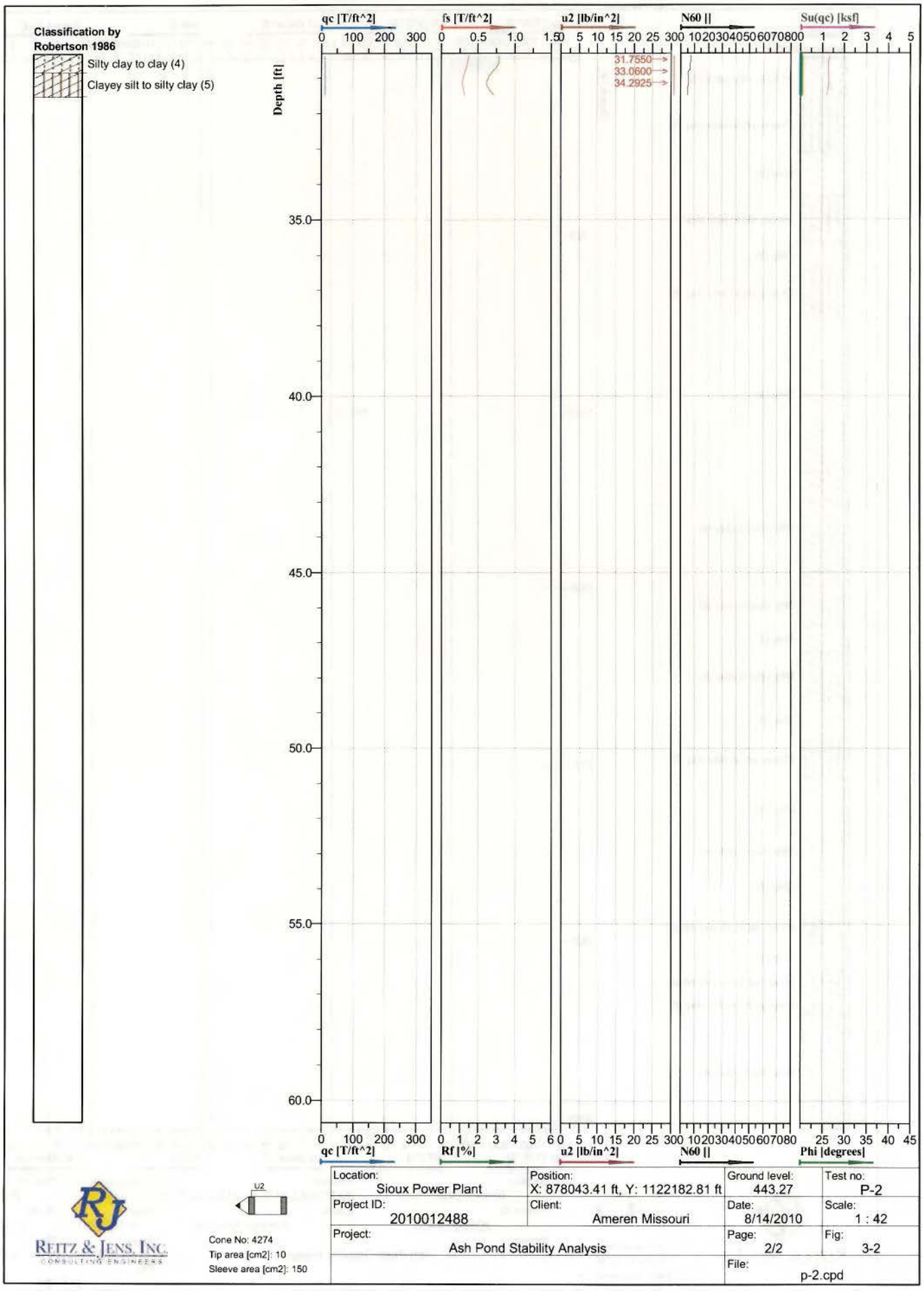


Location: Sioux Power Plant	Position: X: 878043.41 ft, Y: 1122182.81 ft	Ground level: 443.27	Test no: P-2
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42
Project: Ash Pond Stability Analysis		Page: 1/2	Fig: 3-2
		File: p-2.cpd	

RJ
RETTZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location: Sioux Power Plant	Position: X: 878043.41 ft, Y: 1122182.81 ft	Ground level: 443.27	Test no: P-2
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42
Project: Ash Pond Stability Analysis		Page: 2/2	Fig: 3-2
		File: p-2.cpd	

REITZ & JENS, INC.
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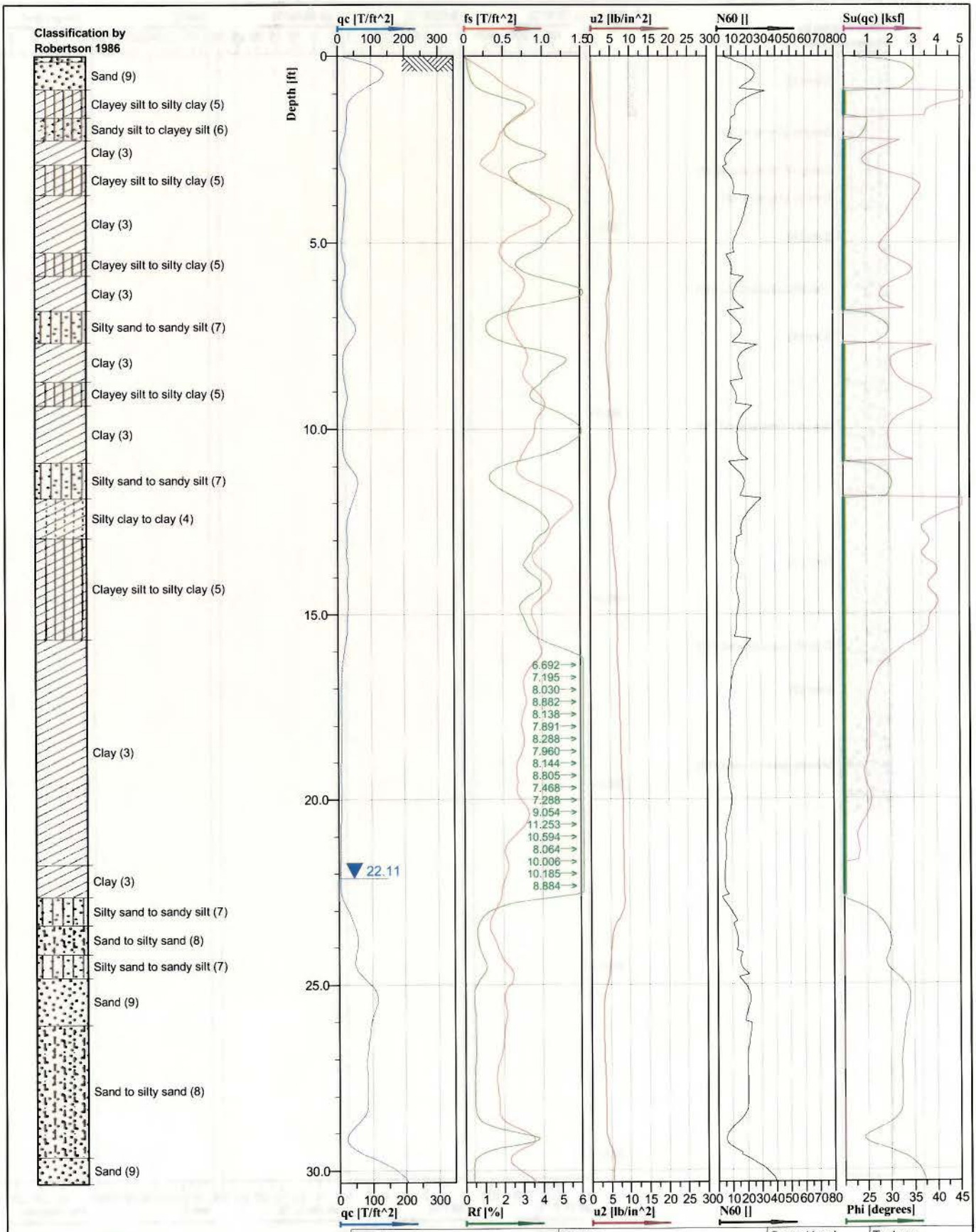
U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

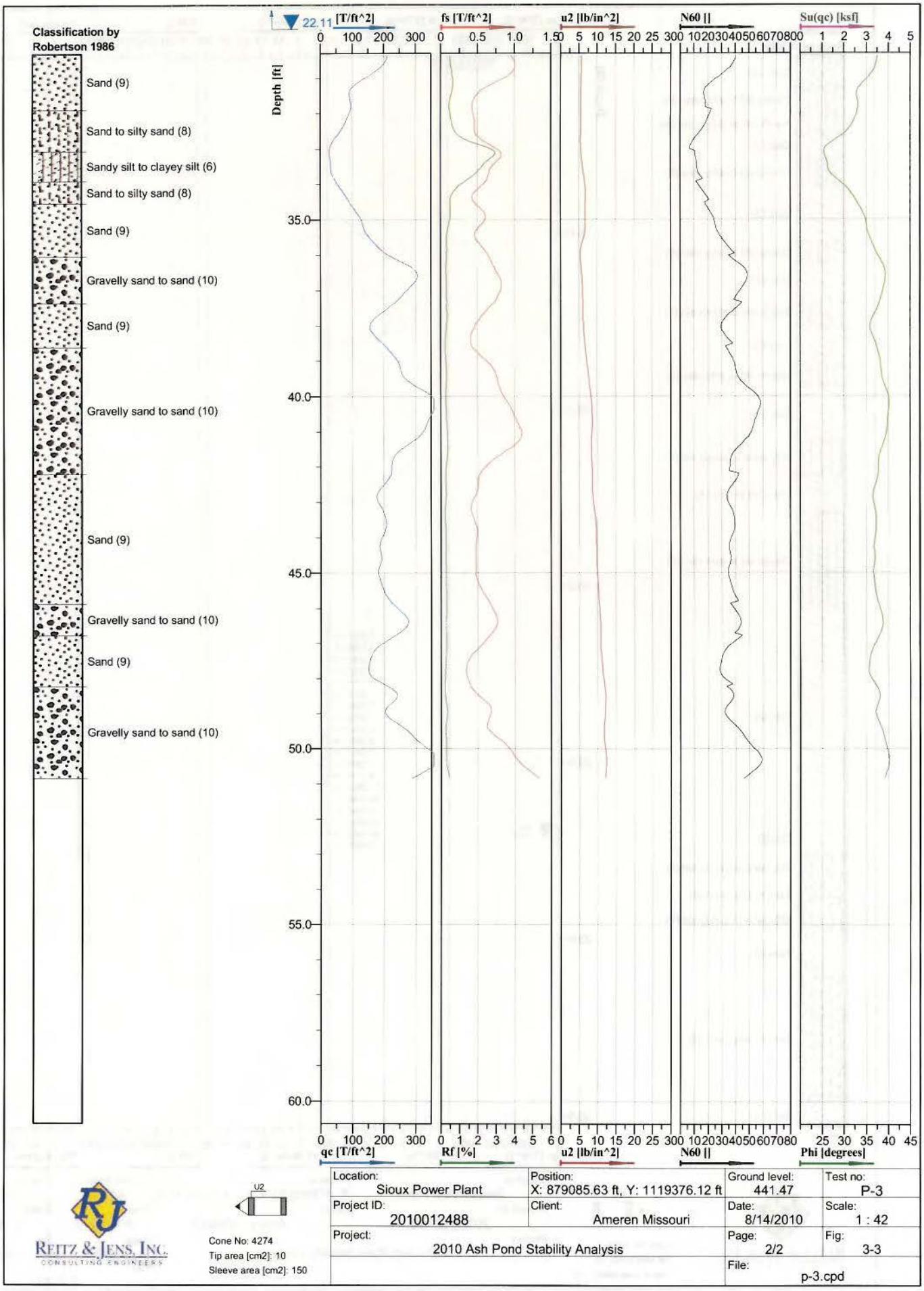


Location: Sioux Power Plant	Position: X: 879085.63 ft, Y: 1119376.12 ft	Ground level: 441.47	Test no: P-3	
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42	
Project: 2010 Ash Pond Stability Analysis		Page: 1/2	Fig: 3-3	
		File: p-3.cpd		

REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

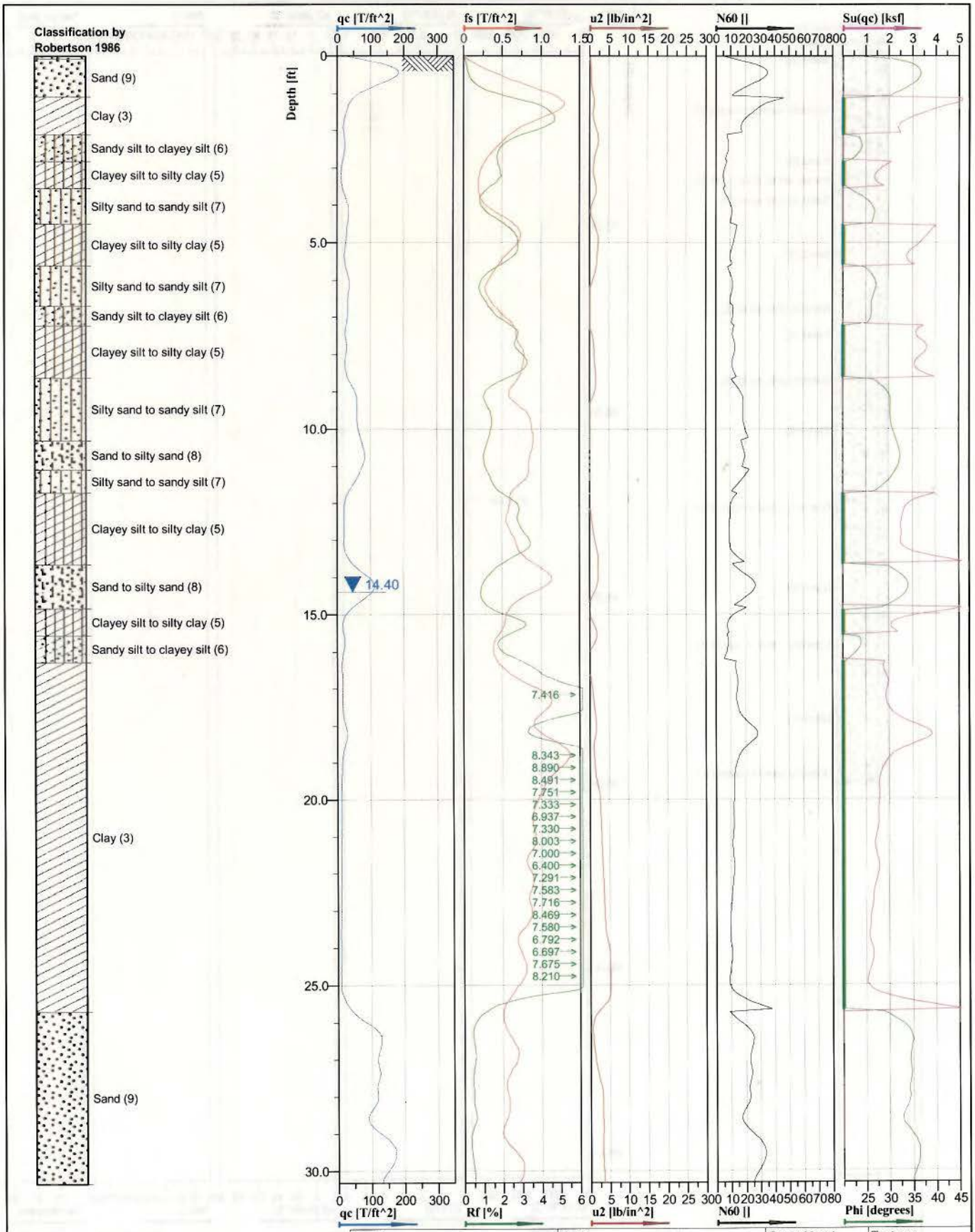


REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Sioux Power Plant	Position: X: 879085.63 ft, Y: 1119376.12 ft	Ground level: 441.47	Test no: P-3
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42
Project: 2010 Ash Pond Stability Analysis		Page: 2/2	Fig: 3-3
		File: p-3.cpd	

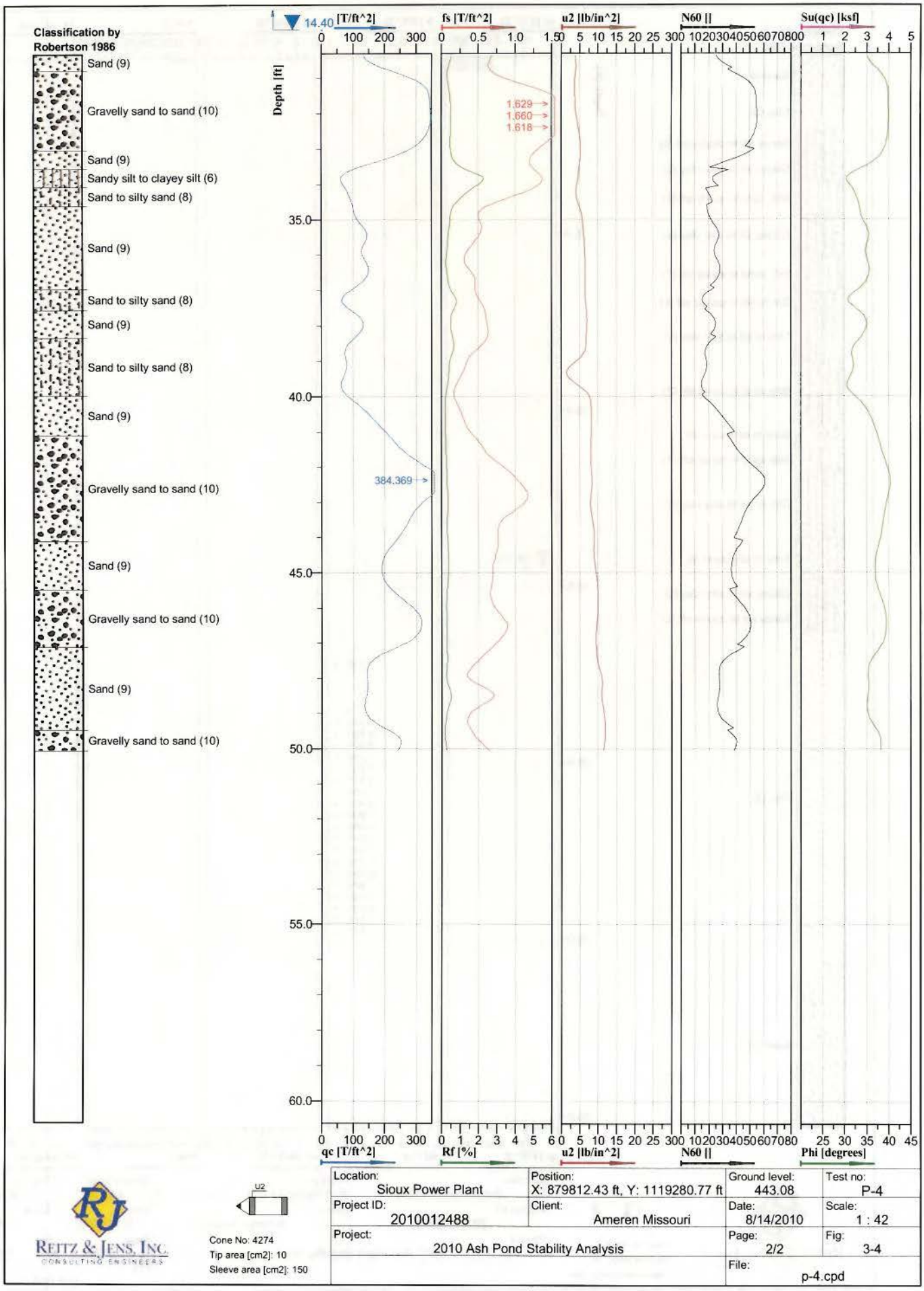


Location: Sioux Power Plant	Position: X: 879812.43 ft, Y: 1119280.77 ft	Ground level: 443.08	Test no: P-4	
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42	
Project: 2010 Ash Pond Stability Analysis		Page: 1/2	Fig: 3-4	
		File: p-4.cpd		

REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

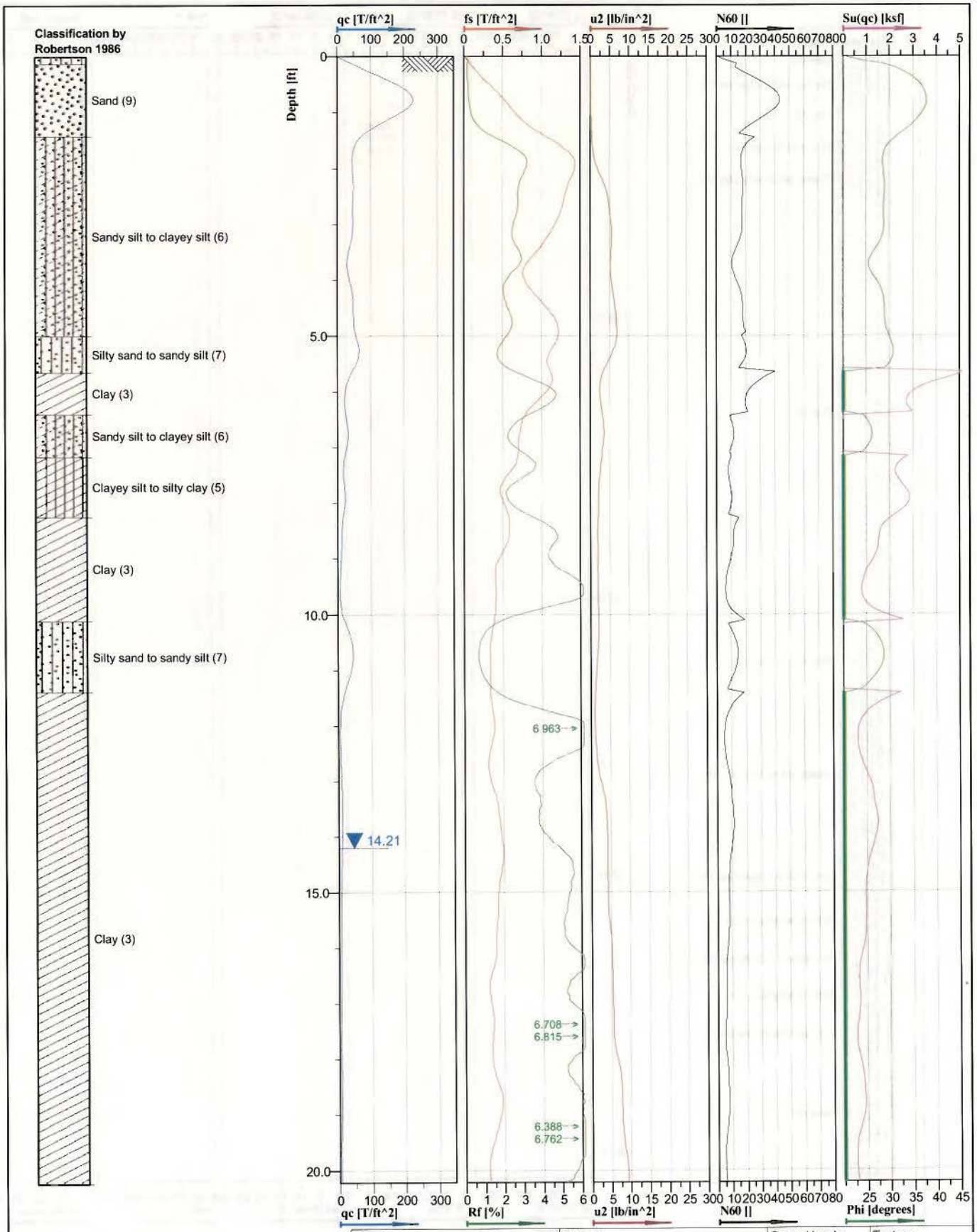


REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Sioux Power Plant	Position: X: 879812.43 ft, Y: 1119280.77 ft	Ground level: 443.08	Test no: P-4
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42
Project: 2010 Ash Pond Stability Analysis		Page: 2/2	Fig: 3-4
		File: p-4.cpd	

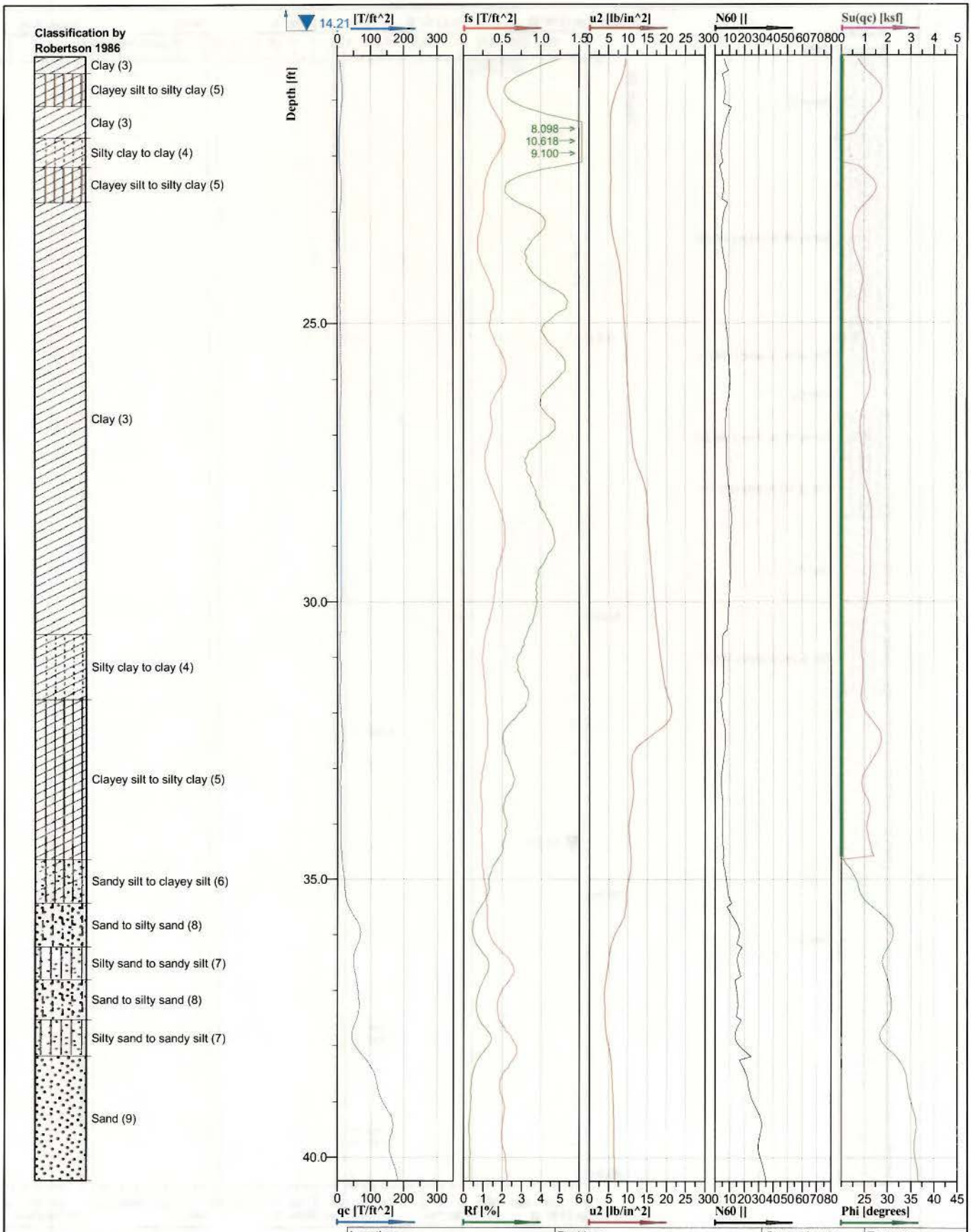


Location: Sioux Power Plant	Position: X: 878362.17 ft, Y: 1122193.34 ft	Ground level: 445.77	Test no: P-8
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 28
Project: 2010 Ash Pond Stability Analysis		Page: 1/3	Fig: 3-5
		File: p-8.cpd	

REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

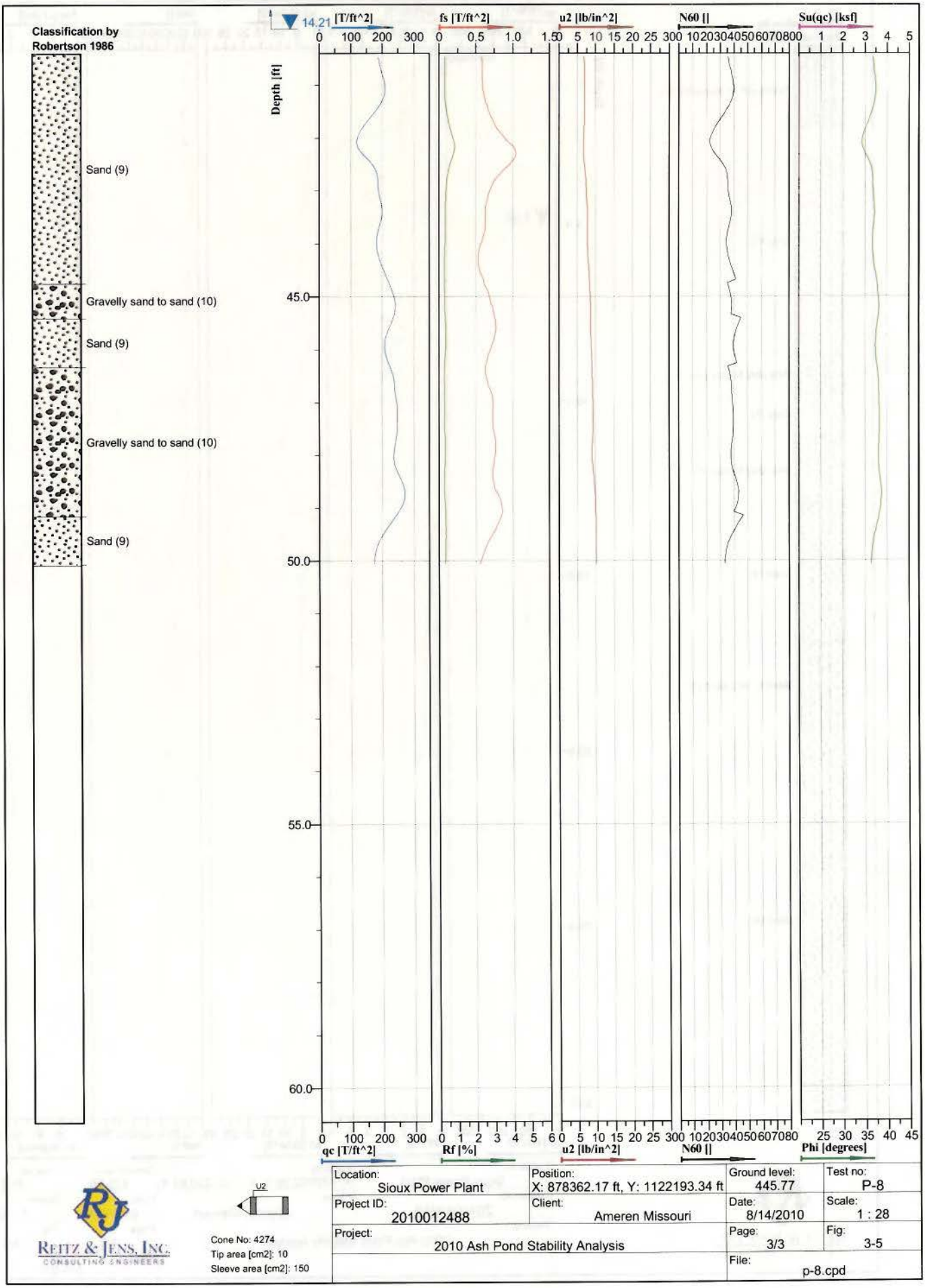


REITZ & JENS, INC.
CONSULTING ENGINEERS

U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Sioux Power Plant	Position: X: 878362.17 ft, Y: 1122193.34 ft	Ground level: 445.77	Test no: P-8
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 28
Project: 2010 Ash Pond Stability Analysis		Page: 2/3	Fig: 3-5
		File: p-8.cpd	



Location: Sioux Power Plant	Position: X: 878362.17 ft, Y: 1122193.34 ft	Ground level: 445.77	Test no: P-8
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 28
Project: 2010 Ash Pond Stability Analysis		Page: 3/3	Fig: 3-5
		File: p-8.cpd	

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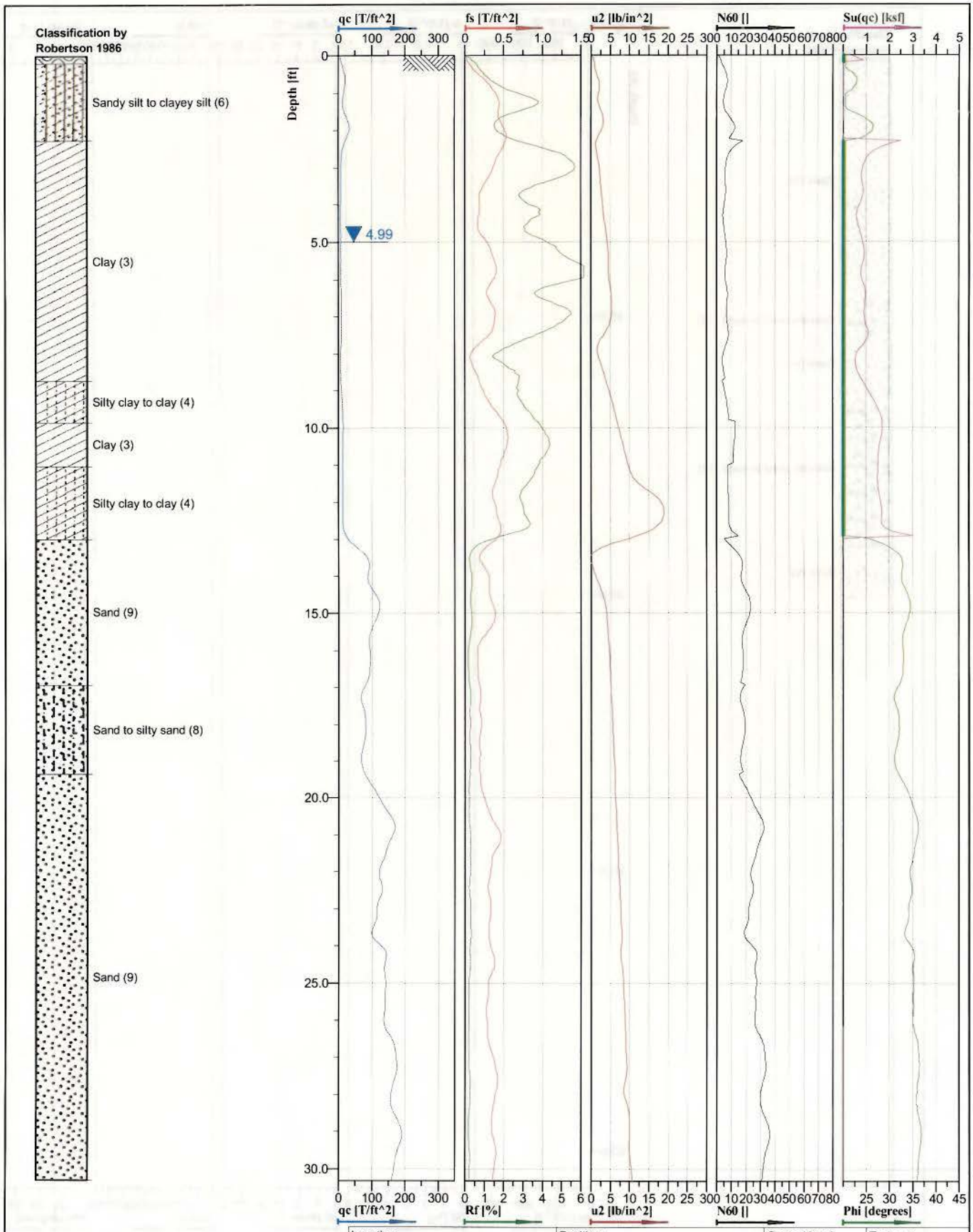
U2

Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location: Sioux Power Plant	Position: X: 878082.28 ft, Y: 1122220.67 ft	Ground level: 425.79	Test no: P-9
Project ID: 2010012488	Client: Ameren Missouri	Date: 8/14/2010	Scale: 1 : 42
Project: 2010 Ash Pond Stability Analysis		Page: 1/2	Fig: 3-6
		File: p-9.cpd	

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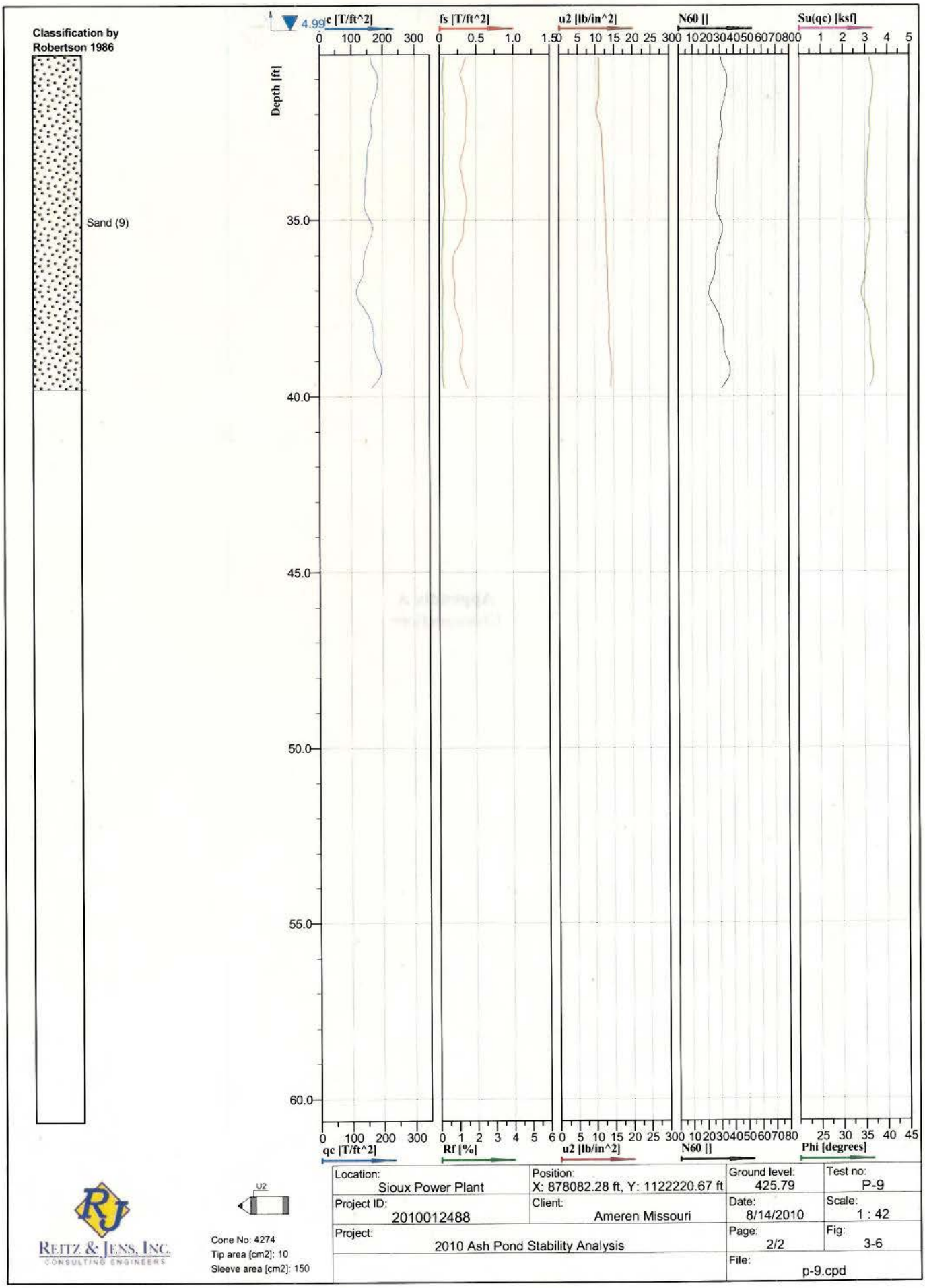
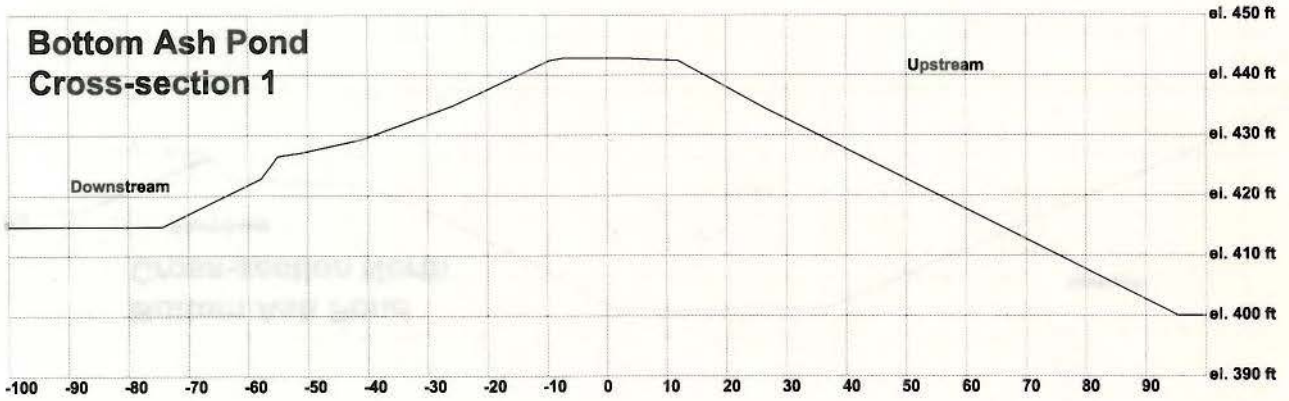

Classification by
Robertson 1986
Sand (9)
4.99
c [T/ft^2]
fs [T/ft^2]
u2 [lb/in^2]
N60 []
Su(qc) [ksf]
Depth [ft]
35.0
40.0
45.0
50.0
55.0
60.0
qc [T/ft^2]
Rf [%]
u2 [lb/in^2]
N60 []
Phi [degrees]
U2
Cone No: 4274
Tip area [cm2]: 10
Sleeve area [cm2]: 150
REITZ & JENS, INC.
CONSULTING ENGINEERS
Location: Sioux Power Plant
Position: X: 878082.28 ft, Y: 1122220.67 ft
Ground level: 425.79
Test no: P-9
Project ID: 2010012488
Client: Ameren Missouri
Date: 8/14/2010
Scale: 1 : 42
Project: 2010 Ash Pond Stability Analysis
Page: 2/2
Fig: 3-6
File: p-9.cpd

Appendix A
Cross-sections

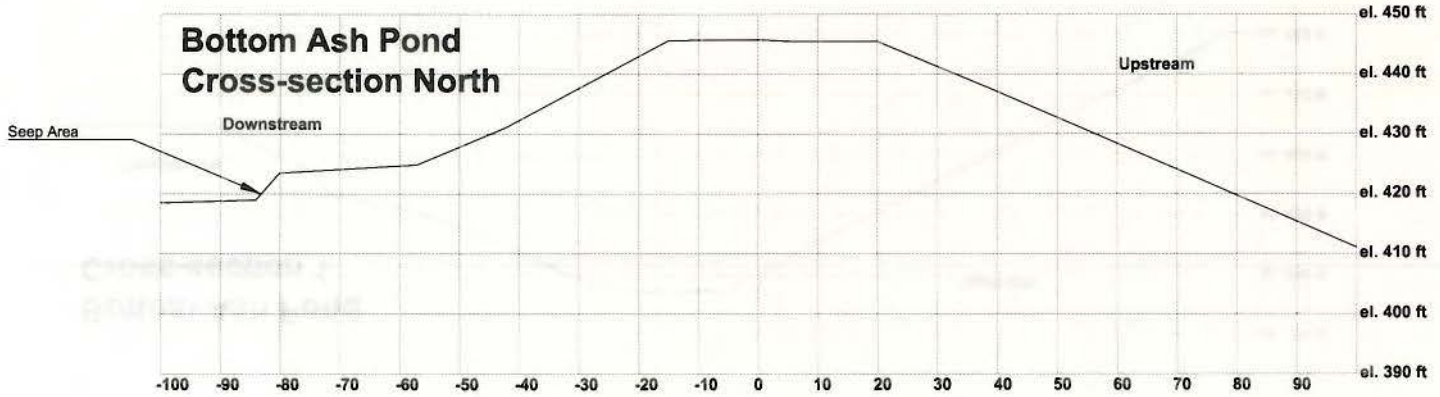
Sioux Power Station



REITZ & JENS, INC.
CONSULTING ENGINEERS
1055 Corporate Square Drive
St. Louis, Missouri 63132

Figure A-1

Sioux Power Station



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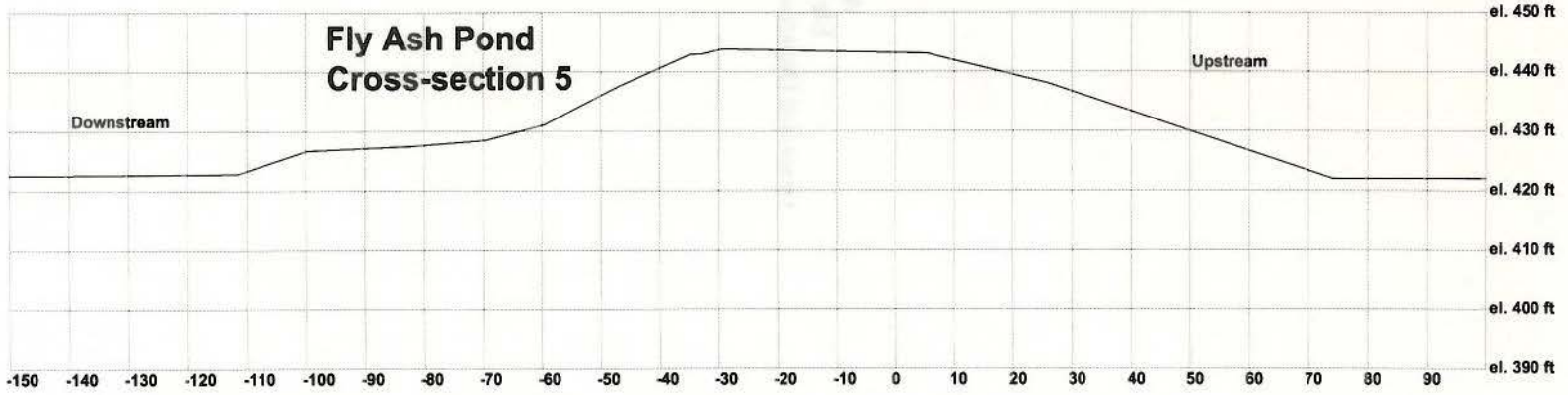
1555 Corporate Square Drive
St. Louis, Missouri 63132

Figure A-2

Sioux Power Station



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St. Louis, Missouri 63132

Figure A-3

Appendix B
Elevation Profile
Graphical Depictions of Slope Stability Models

Sioux Power Station

Elevation Profile

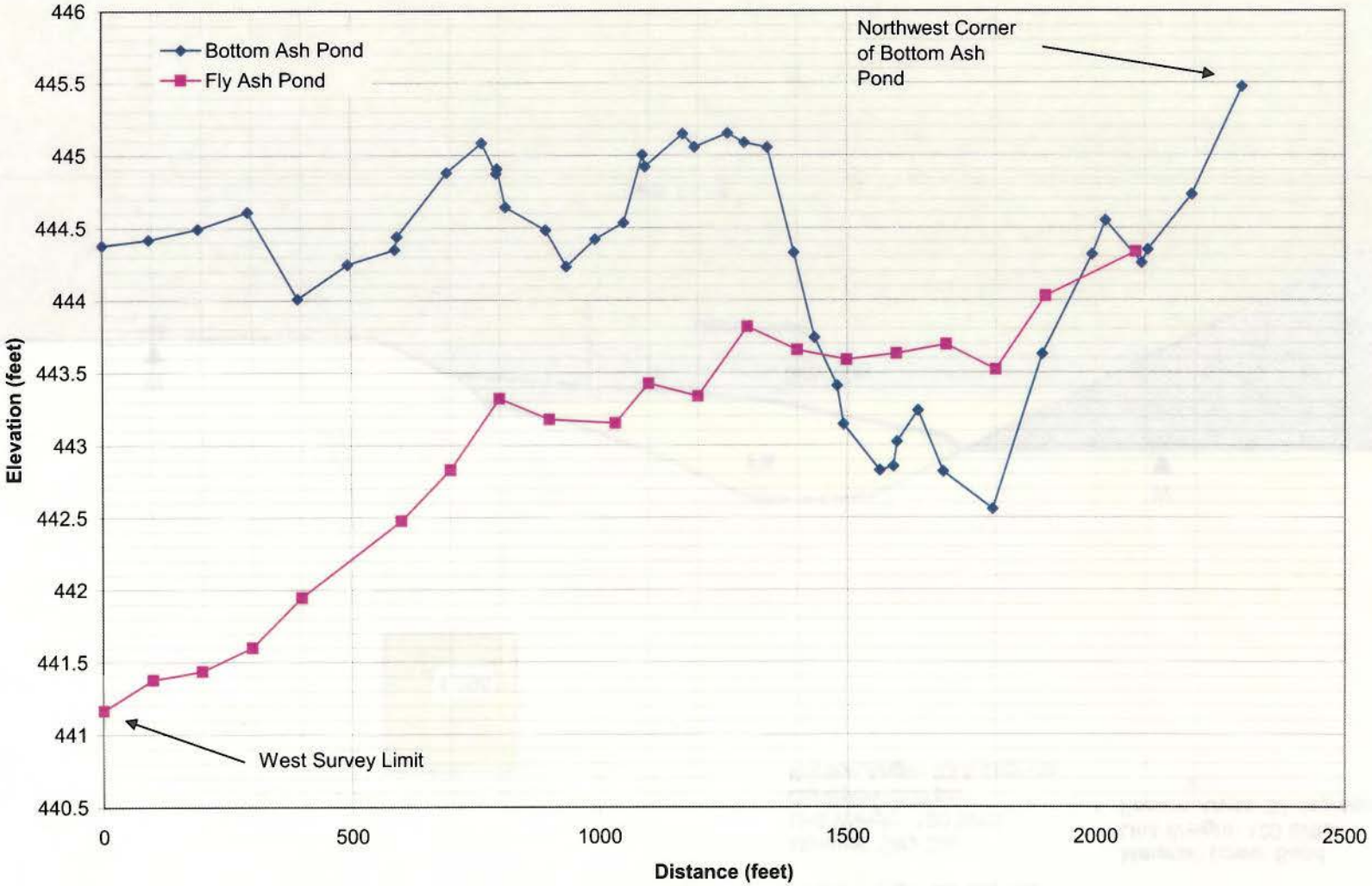

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Figure B-1

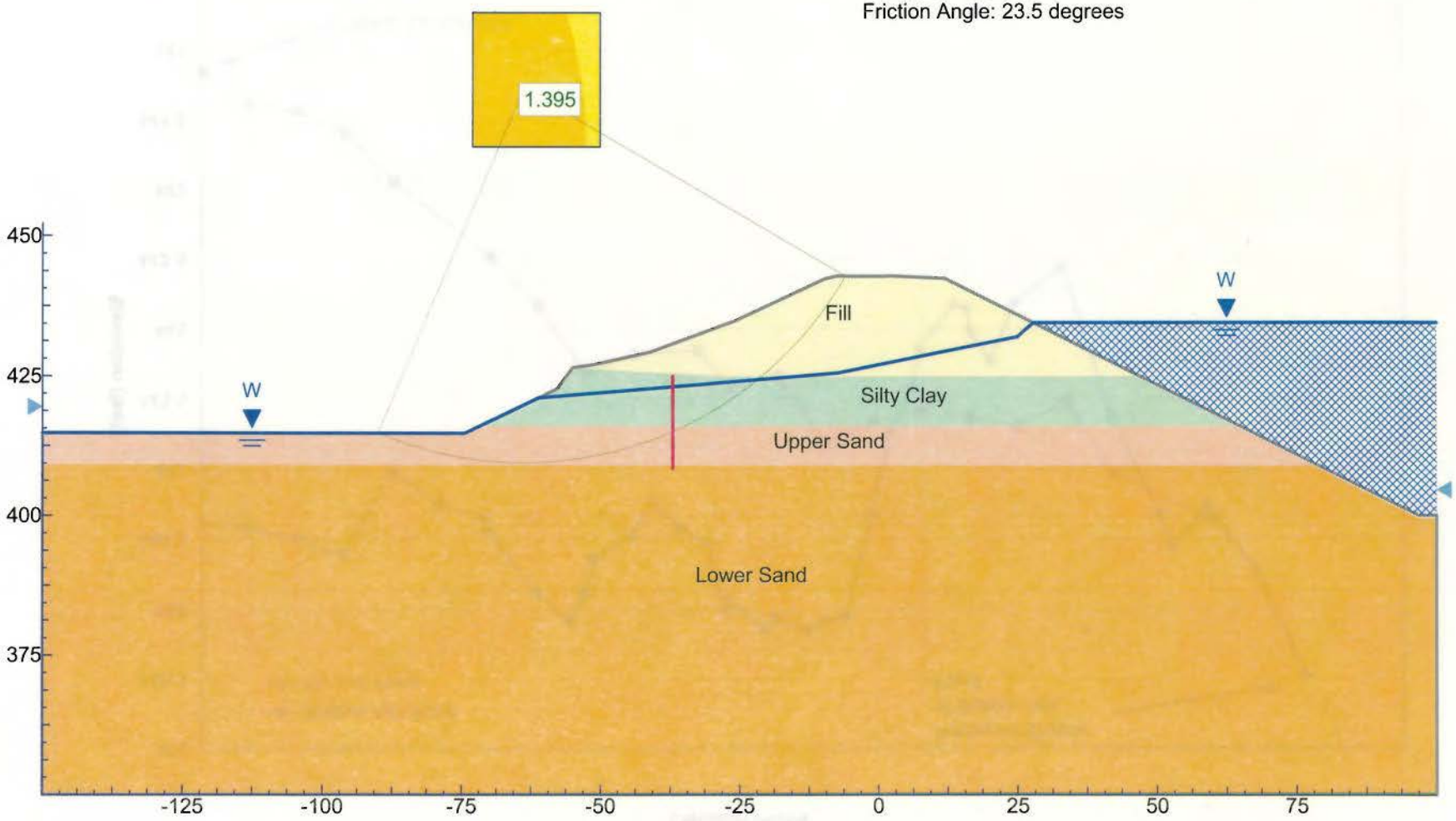
Sioux Power Station
Steady Seepage, Full Reservior
Cross-section 1

Material: Fill
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 26 degrees

Material: Silty Clay
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Material: Upper Sand
Unit Weight: 120 lb/ft3
Friction Angle: 30 degrees

Material: Lower Sand
Unit Weight: 120 lb/ft3
Friction Angle: 33 degrees



Reitz & Jens, Inc. *Consulting Engineers*

Figure B-2

Sioux Power Station
Steady Seepage, Maximum Reservior
Cross-section 1

Material: Fill
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 26 degrees

Material: Silty Clay
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Material: Upper Sand
Unit Weight: 120 lb/ft3
Friction Angle: 30 degrees

Material: Lower Sand
Unit Weight: 120 lb/ft3
Friction Angle: 33 degrees

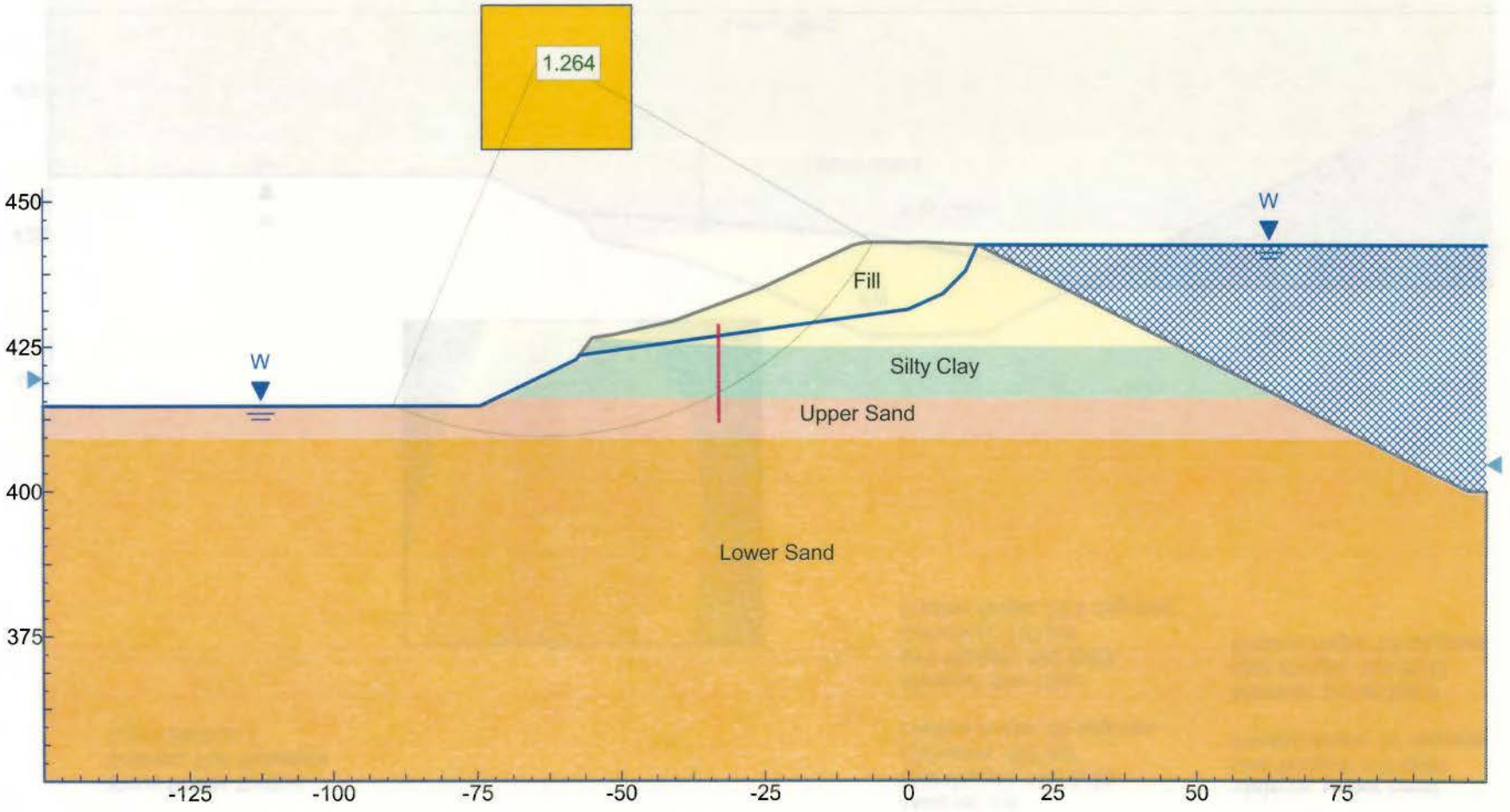


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Figure B-3

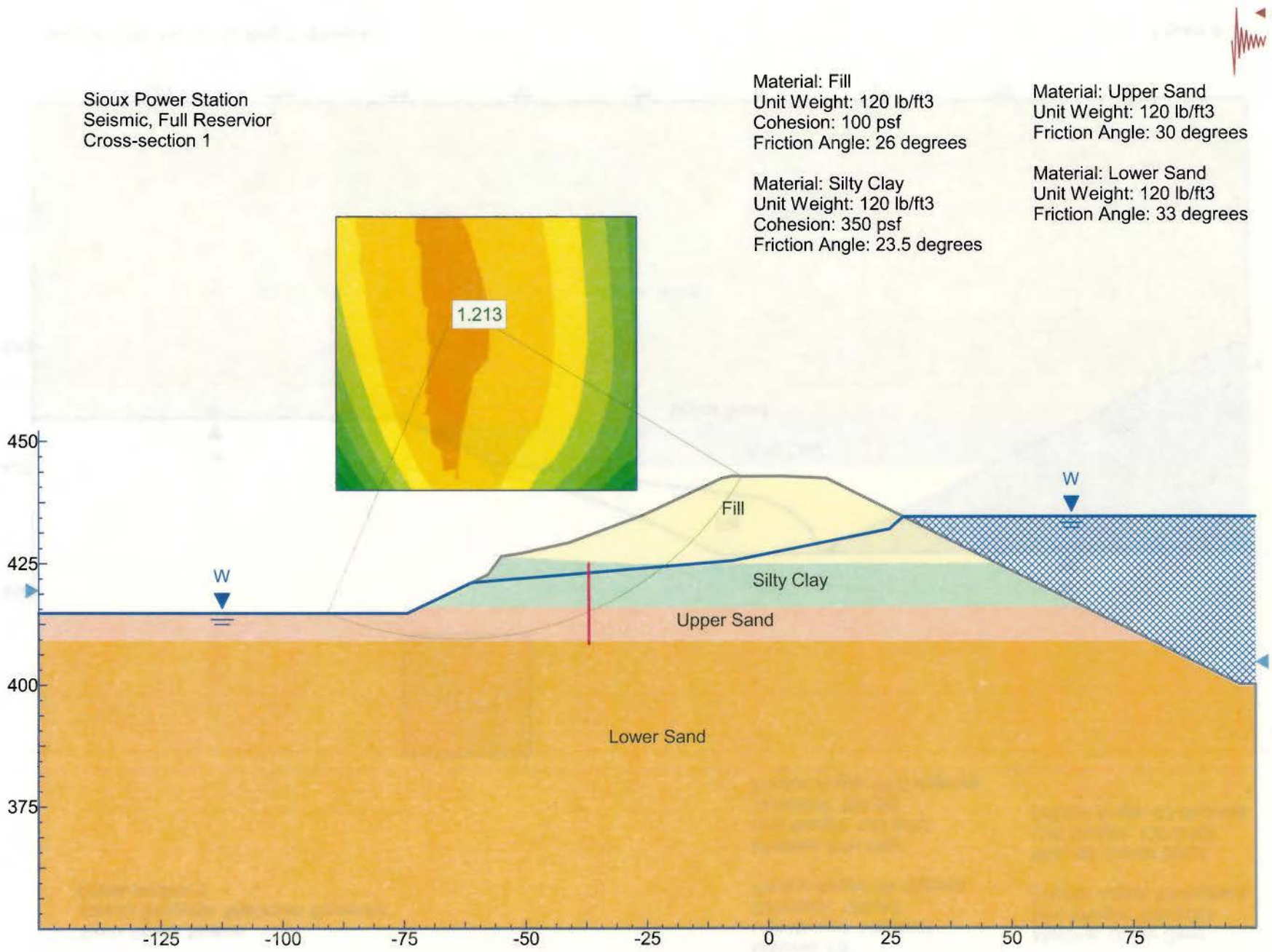

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Figure B-4

Sioux Power Station
Steady Seepage, Full Reservior
Cross-section 5

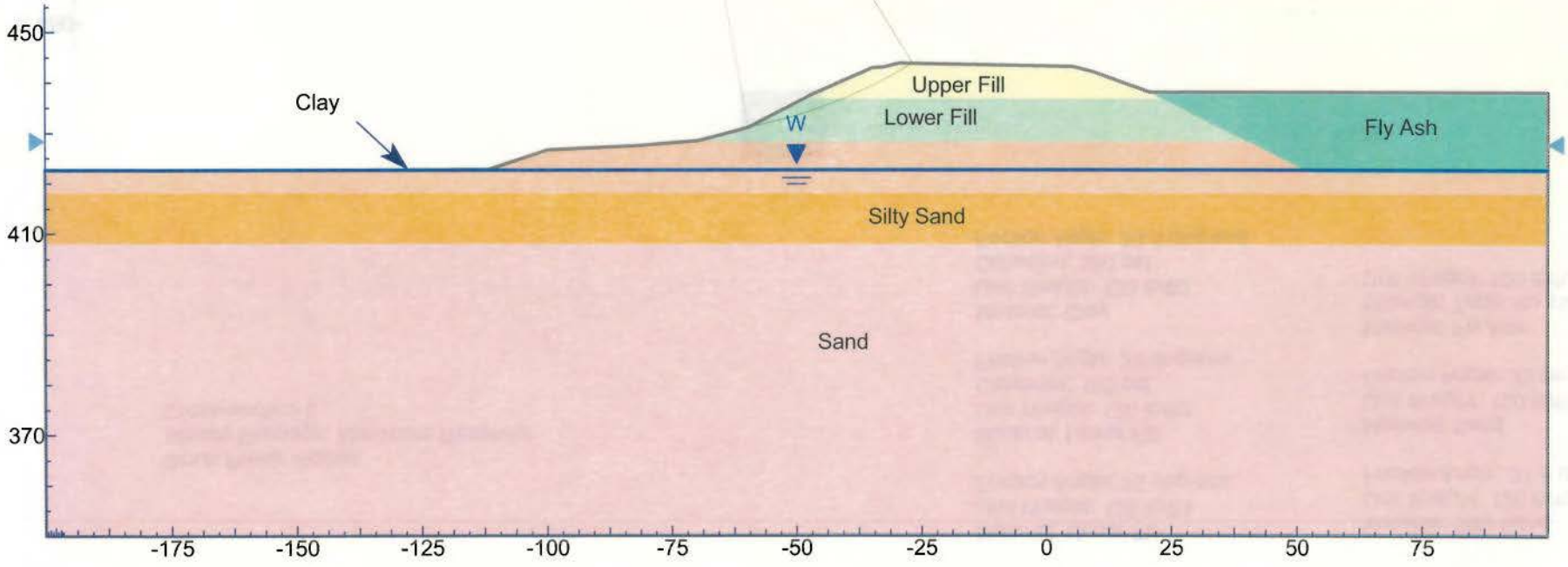

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Figure B-5

Sioux Power Station
Steady Seepage, Maximum Reservior
Cross-section 5

Material: Upper Fill
Unit Weight: 120 lb/ft3
Friction Angle: 25 degrees

Material: Lower Fill
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 28 degrees

Material: Clay
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Material: Silty Sand
Unit Weight: 120 lb/ft3
Friction Angle: 27.5 degrees

Material: Sand
Unit Weight: 120 lb/ft3
Friction Angle: 33 degrees

Material: Fly Ash
Strength Type: No strength
Unit Weight: 100 lb/ft3

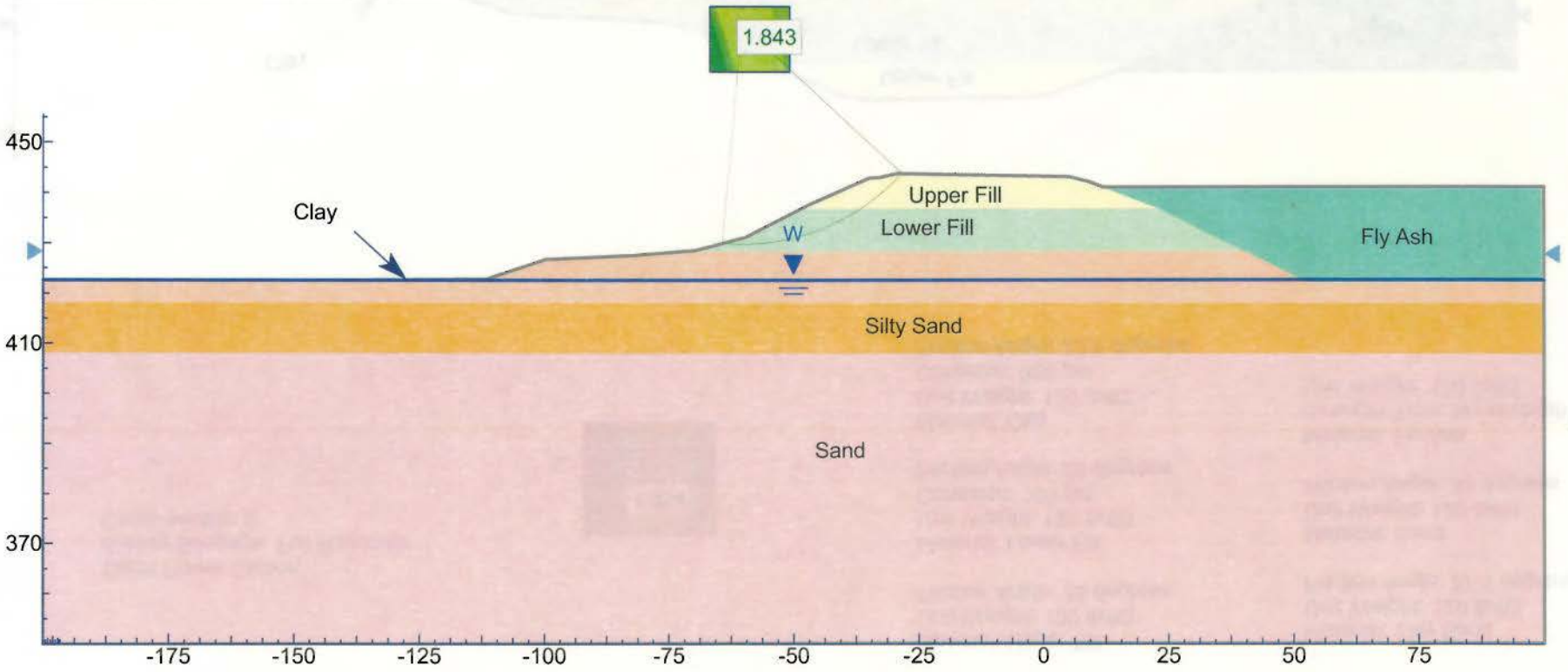

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Figure B-6

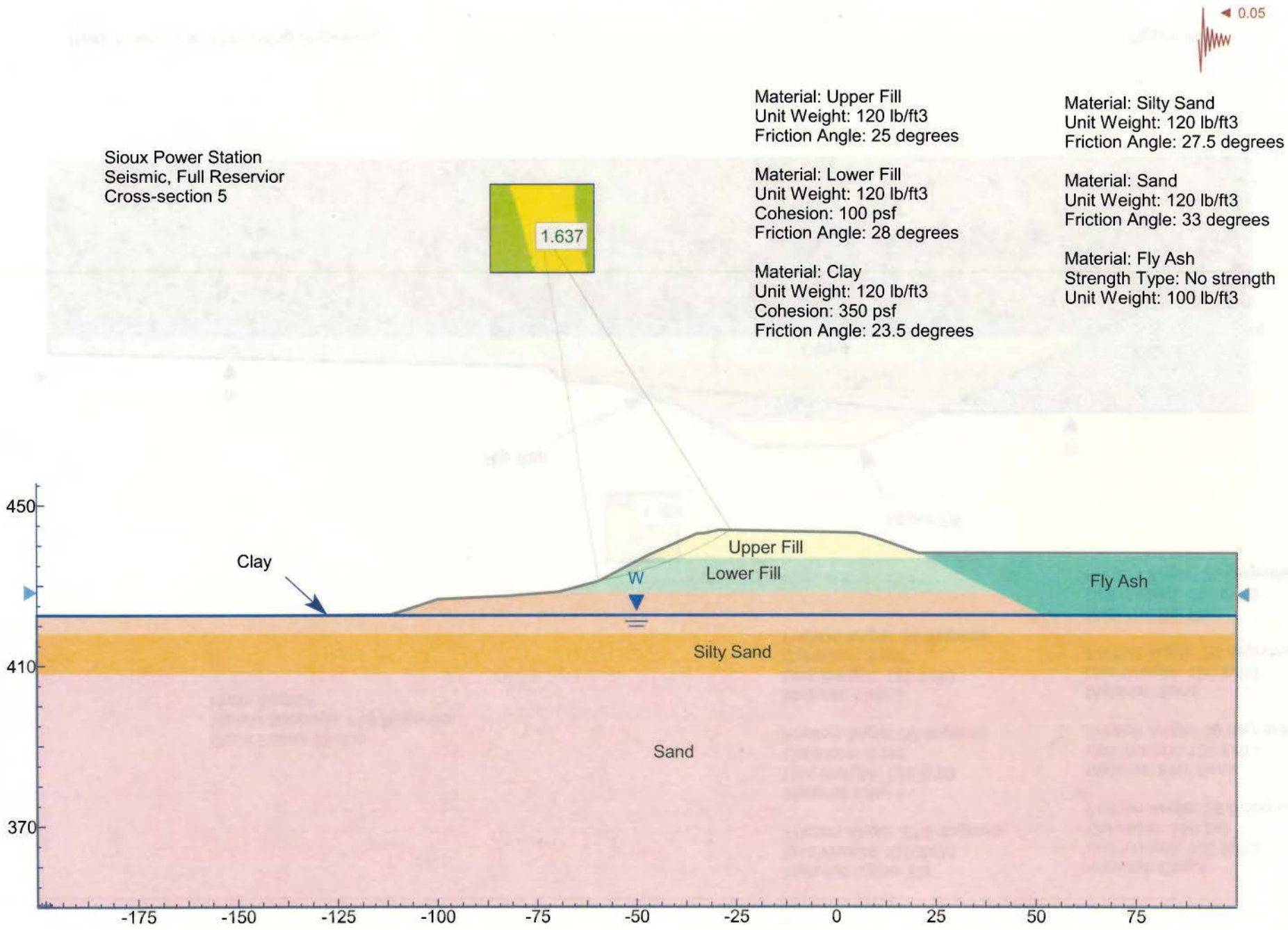

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Figure B-7

Sioux Power Station
Steady Seepage, Full Reservior
North Section

Material: Upper Fill
Unit Weight: 120 lb/ft3
Friction Angle: 27.5 degrees

Material: Clay 1
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 30 degrees

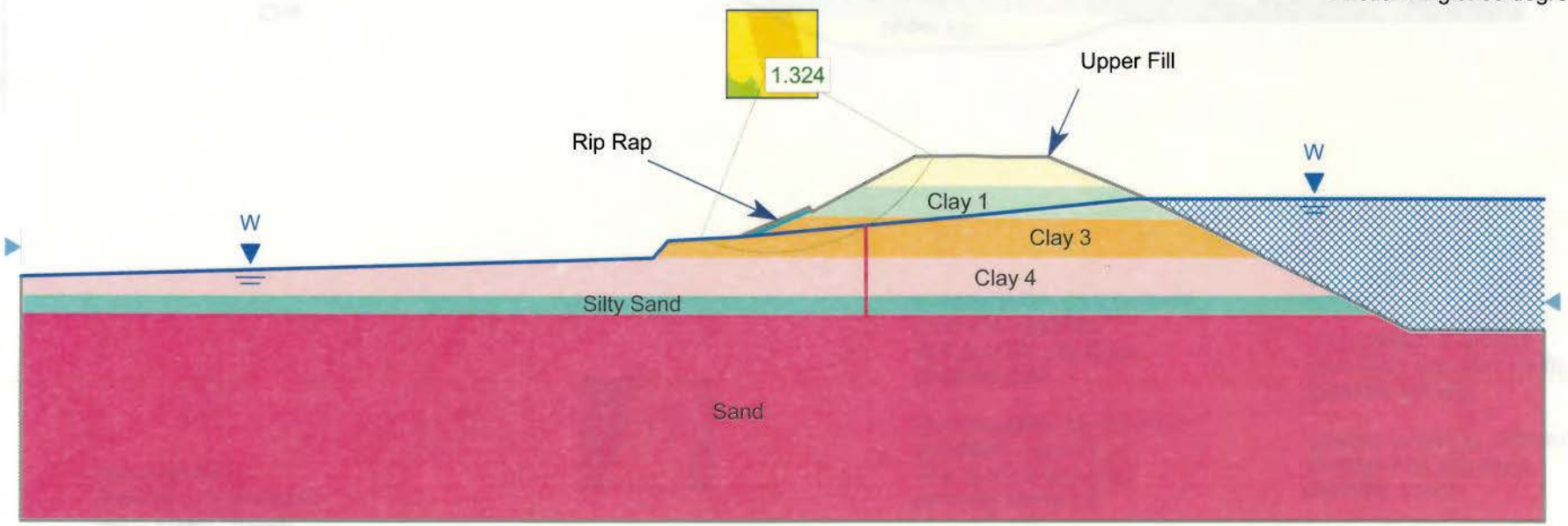
Material: Clay 3
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 28 degrees

Material: Clay 4
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Material: Silty Sand
Unit Weight: 120 lb/ft3
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 120 lb/ft3
Friction Angle: 35 degrees

Material: Rip Rap
Unit Weight: 110 lb/ft3
Friction Angle: 35 degrees



◀ 0.05

Sioux Power Station
Seismic, Full Reservior
North Section

Material: Upper Fill
Unit Weight: 120 lb/ft3
Friction Angle: 27.5 degrees

Material: Clay 1
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 30 degrees

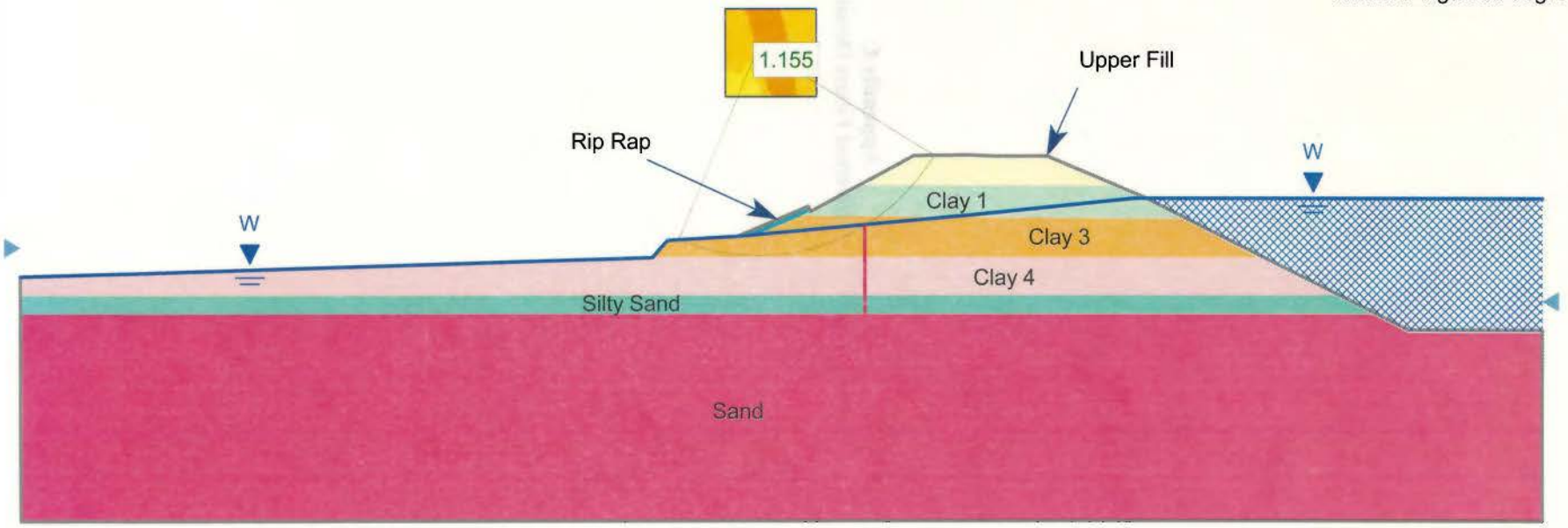
Material: Clay 3
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 28 degrees

Material: Clay 4
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

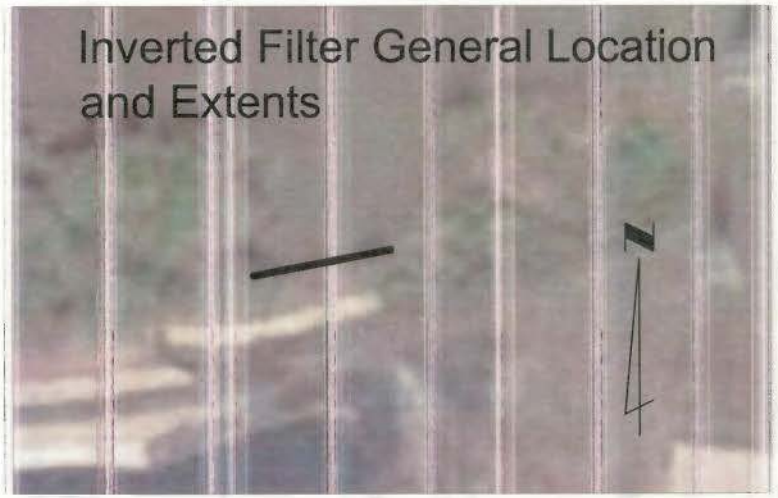
Material: Silty Sand
Unit Weight: 120 lb/ft3
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 120 lb/ft3
Friction Angle: 35 degrees

Material: Rip Rap
Unit Weight: 110 lb/ft3
Friction Angle: 35 degrees



Appendix C
Inverted Filters Details

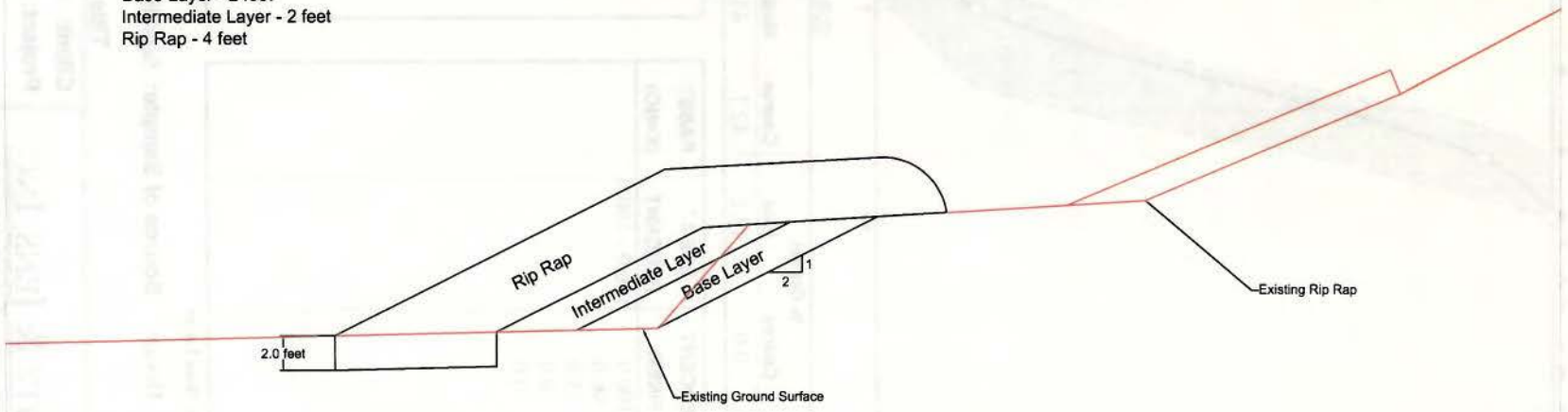


Sioux Power Station

Inverted Filter
General Location and Extents
Cross-section

Inverted Filter Cross-section

Layer Thickness
Base Layer - 2 feet
Intermediate Layer - 2 feet
Rip Rap - 4 feet



Dimension Shown on Sketch are Approximate

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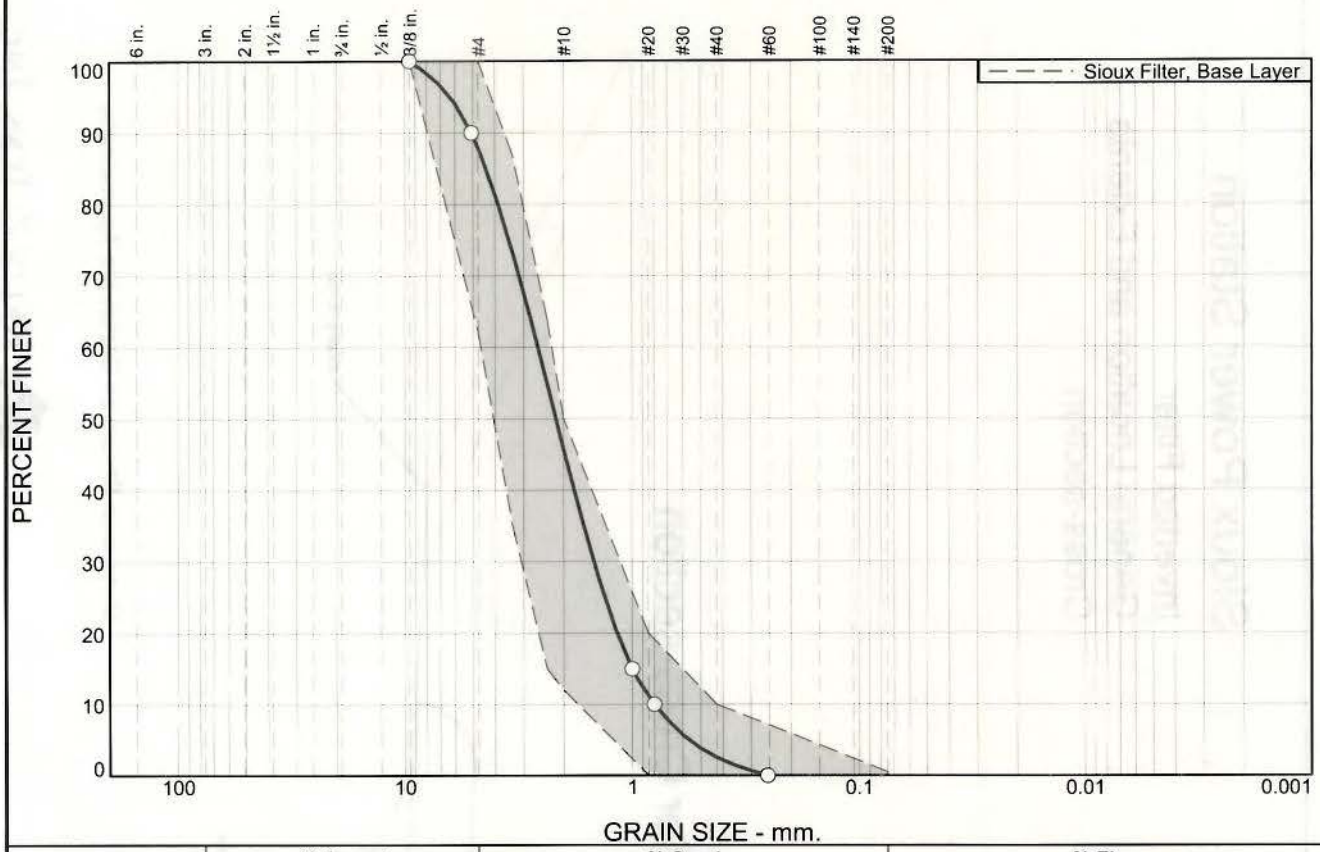
Figure C-1

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.1	42.1	43.3	2.5	0.0	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0	100.0 - 100.0	
.2	90.0		
.03937	15.0		
.0315	10.0		
.01	0.0		

* Sioux Filter, Base Layer

Material Description

Inverted Filter, Base Layer

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 4.3793 D_{60}= 2.5959 D_{50}= 2.1621
D_{30}= 1.4724 D_{15}= 1.0000 D_{10}= 0.8001
C_u= 3.24 C_c= 1.04

Date Tested: **Tested By:**

Remarks

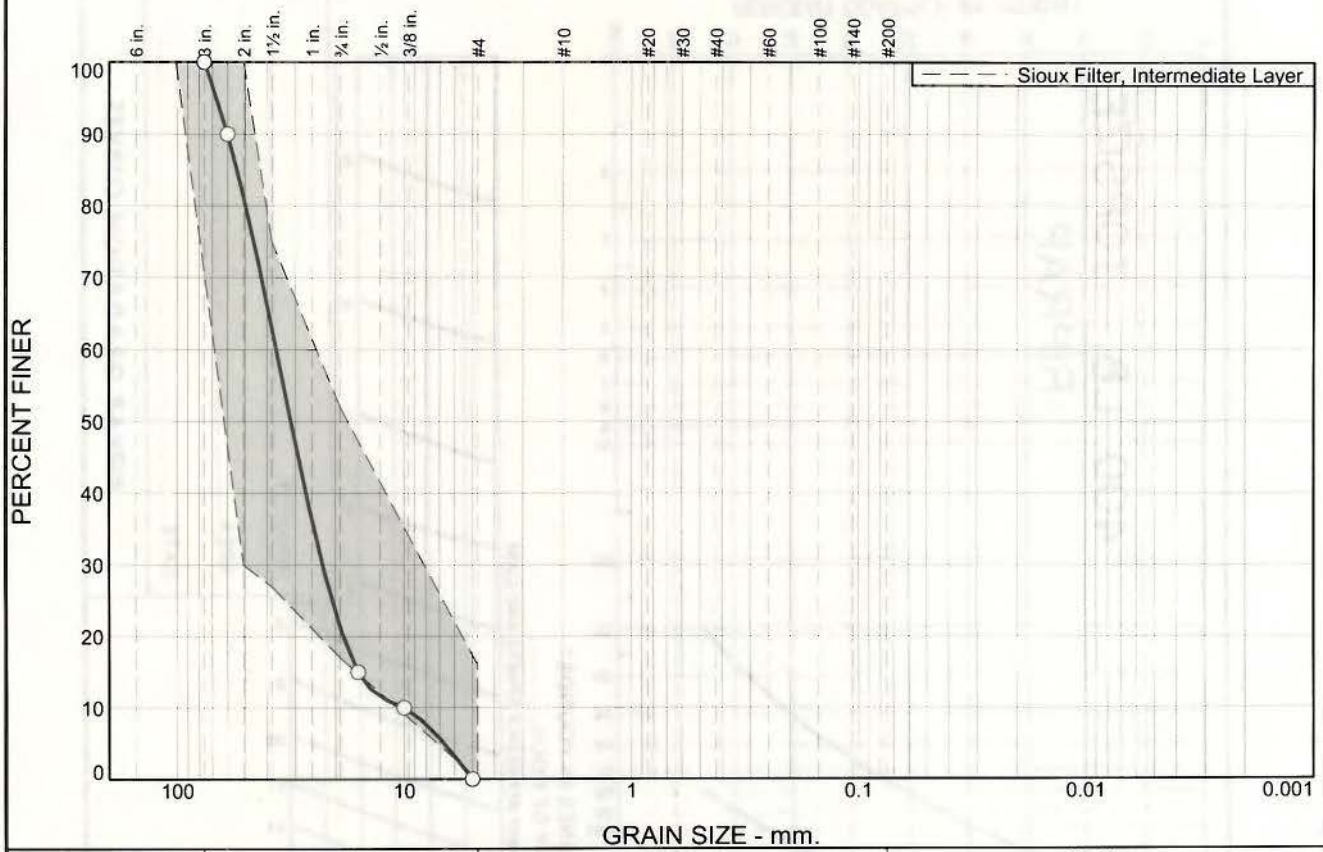
Sample No.: Design **Source of Sample:** Sand Boil Location **Date Sampled:**
Location: **Elev./Depth:** Lift 1
Checked By: **Title:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage

Project No: 2010012488 **Figure** C-2

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	78.8	21.2	0.0	0.0	0.0	0.0	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2.3622	90.0		
.625	15.0		
.3937	10.0		
.19685	0.0		

* Sioux Filter, Intermediate Layer

Material Description

Inverted Filter, Intermediate Layer

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 54.4038 D_{60}= 36.4948 D_{50}= 31.4564
D_{30}= 22.7890 D_{15}= 15.8750 D_{10}= 10.0000
C_u= 3.65 C_c= 1.42

Date Tested: **Tested By:**

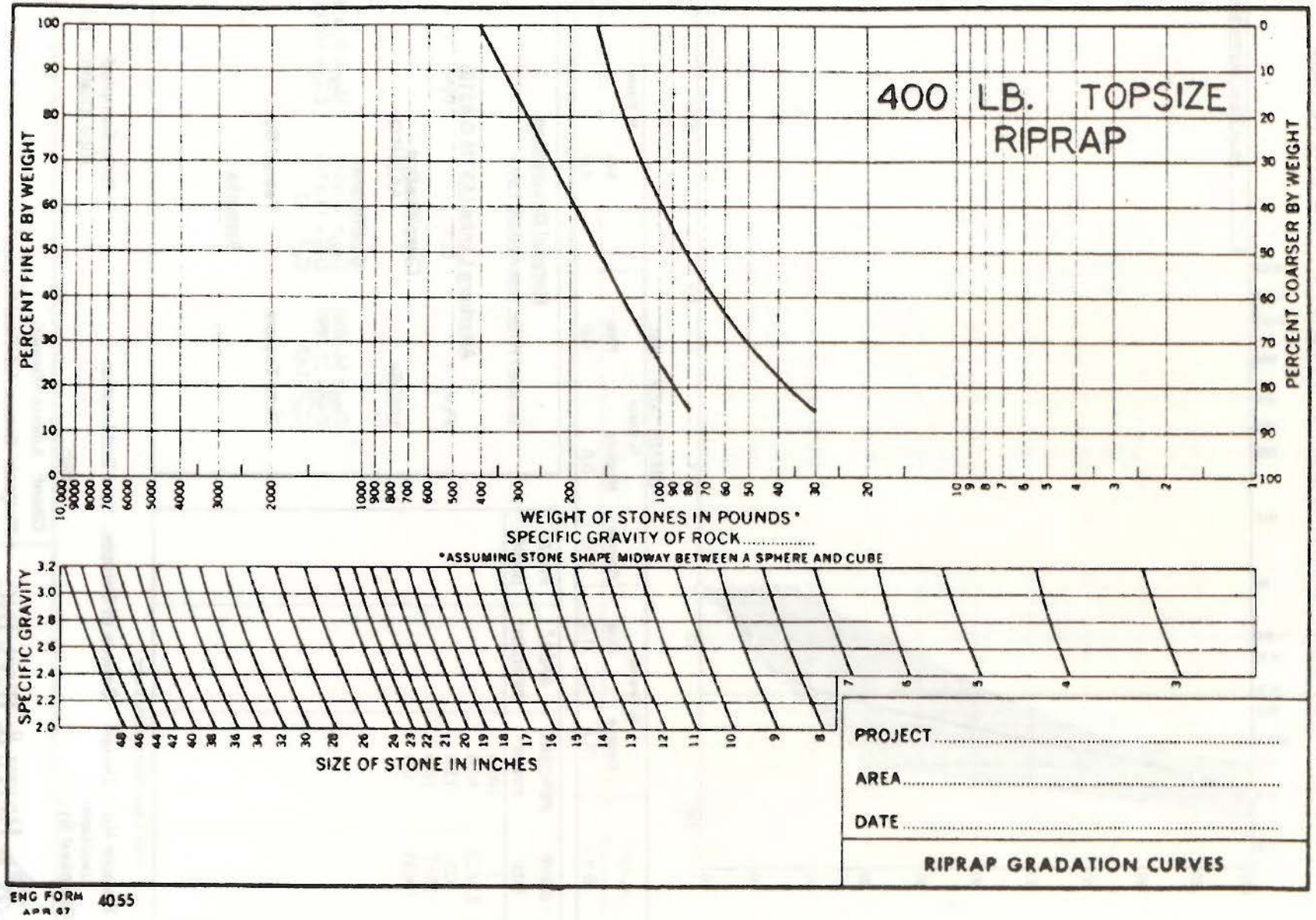
Remarks

Sample No.: Design **Source of Sample:** Sand Boil Location **Date Sampled:**
Location: **Elev./Depth:** Lift 2
Checked By: **Title:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Ameren Missouri
Project: Bottom Ash Pond Seepage
Project No: 2010012488 **Figure** C-3

Rip Rap Layer



APPENDIX A

Document 7

Letter to Ameren Missouri from Reitz & Jens, July 19, 2011, Including Ash Pond Stability Recommendations

REITZ & JENS, INC.
CONSULTING ENGINEERS

1055 corporate square drive
st. louis, missouri 63132
phone: 314.993.4132
fax: 314.993.4177
www.reitzjens.com

July 29, 2011

Mr. Matt Frerking
Managing Supervisor – Dam Safety
Ameren Missouri
3700 South Lindberg, MC F-604
Sunset Hills, Missouri 63127

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RE: Ash Pond Stability Recommendations
Sioux Power Station

Dear Mr. Frerking:

Reitz & Jens performed analyses of the Sioux Power Station ash pond embankments in November 2010, and found two areas of the Bottom Ash Pond which had factors of safety (FS) less than 1.5 for full pond ("reservoir"), steady-state seepage, and long-term (drained) shear strength properties. Ameren Missouri asked Reitz & Jens to re-analyze these areas and to provide recommendations for increasing the FS to 1.5 or greater for those areas where the FS is now less than 1.5.

Attached to this letter are graphical depictions and summaries of slope stability analyses for three cross-sections. The attached stability analyses results show the FS for the existing exterior slopes of the embankment cross-sections and, if applicable, for the modified cross-sections. The full pool was assumed to be at el. 434.5 in our analyses, with a linear phreatic surface through the embankments. The locations of the cross-sections are shown in Figure 1.

An iterative process with SLIDE 5.0 was used to evaluate slope geometries in order to achieve a minimum FS of 1.5. The FS for the existing exterior slopes and recommended modified slopes are summarized in the following table.

	Factor of Safety	
Cross-section	Existing Long-term	Improved Long-term
1 (Northwest)	1.40	1.64
North (Northeast)	1.32	1.52
2 (West)	1.51	N/A

*Based on required design acceleration per MDNR 10 CSR 22-3

For cross-section 1, we recommend constructing a rock wedge along the adjacent slope of the drainage channel slope to increase the FS to 1.5. The rock wedge should be a minimum of 3 feet thick and built to a maximum 2H:1V slope where the slopes of the drainage channel are higher or steeper than the drainage channel slope shown in cross-section 2. A 17-foot wide by 4-foot thick stability berm is recommended for the north cross-section to achieve a minimum FS of 1.5. The extent of these stabilization measures should be determined by a topographic survey of the area.

Please let us know if you have any questions regarding this letter or any other slope stability aspects of the project. We appreciate this opportunity to continue our working relationship with Ameren Missouri.

Sincerely,
REITZ & JENS, Inc.

Jeffrey D. Bertel, P.E.
Project Engineer

Jeffrey L. Fouse, P.E.
Senior Project Manager

The following figures are attached and complete this report:

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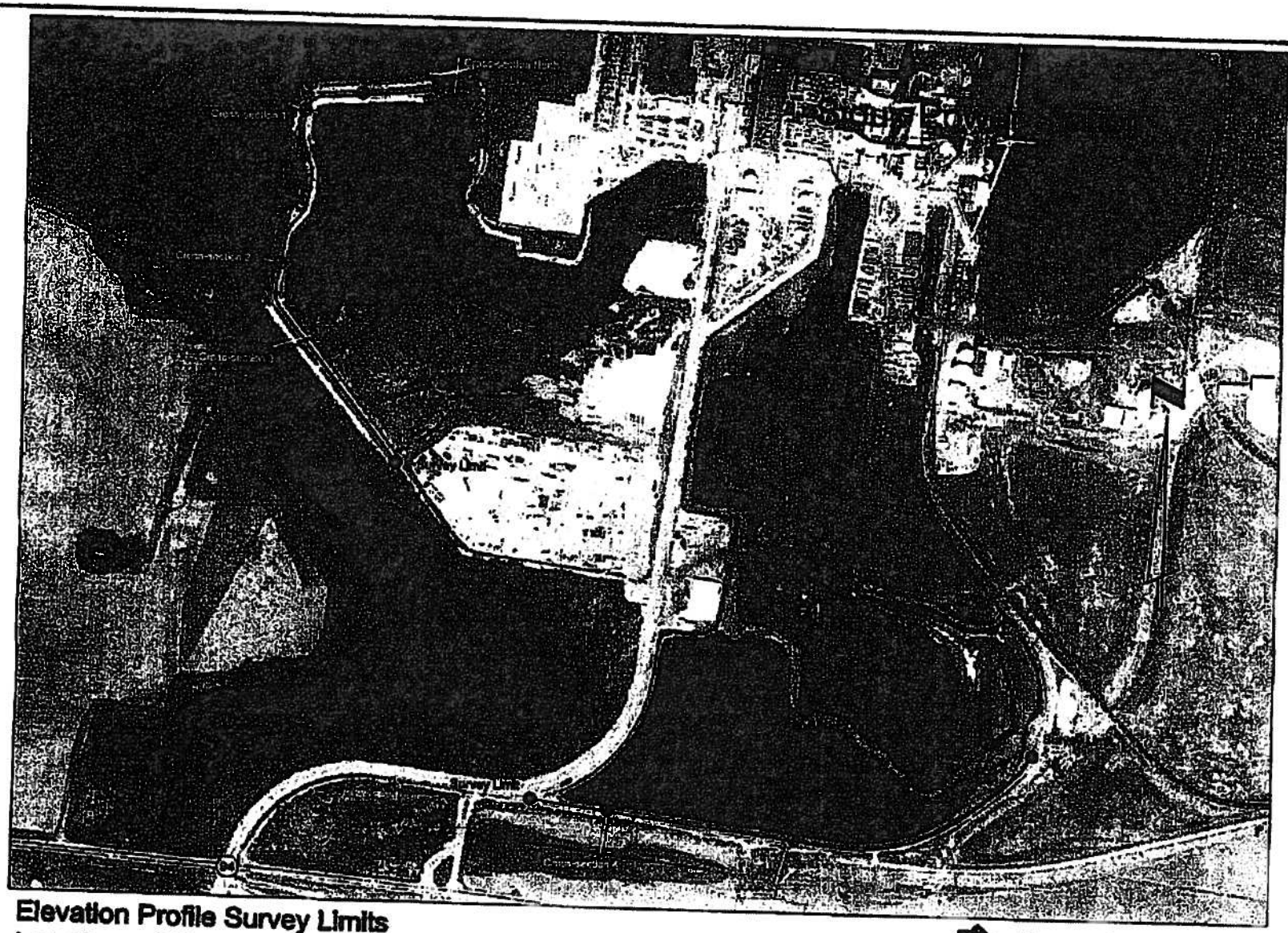
Figure 1 Location of Cross-sections
Figure 2 Cross-section 1 (Northwest), Existing, Long-term
Figure 3 Cross-section 1 (Northwest), Improved, Long-term
Figure 4 North Cross-section, Existing, Long-term
Figure 5 North Cross-section, Improved, Long-term
Figure 6 Cross-section 2 (West), Existing, Long-term

p:\amerenue\2010012488\sioux and meramec repairs\sioux\report\sioux stability recommendations-072911.doc



Elevation Profile Survey Limits
Locations of Cross-section and Borings

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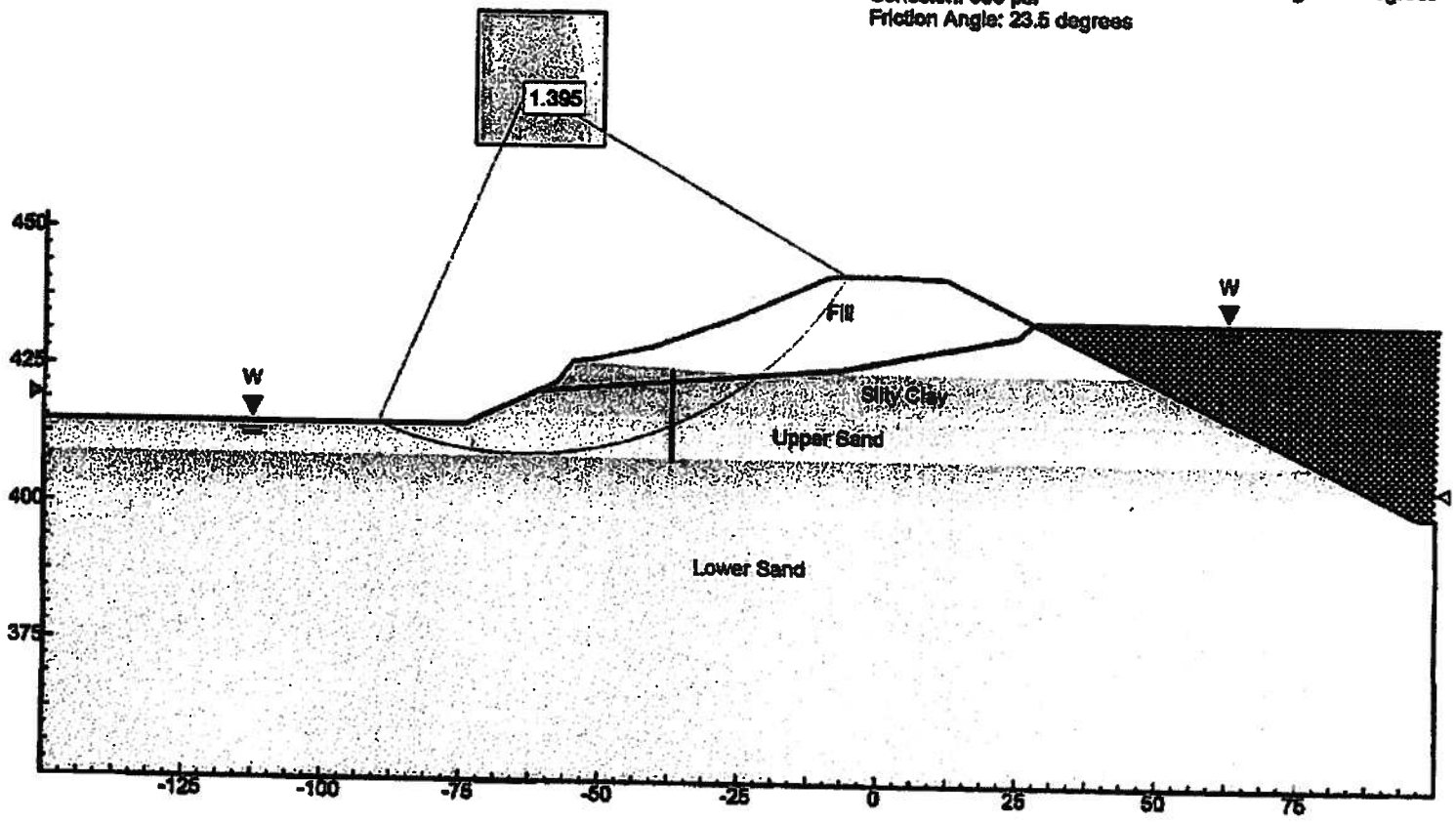
CONSULTING ENGINEERS

Figure 1



Ameren Missouri: Sioux Power Station
Steady Seepage, Full Reservior
Cross-section 1

REITZ & JENS, INC.

Figure 2

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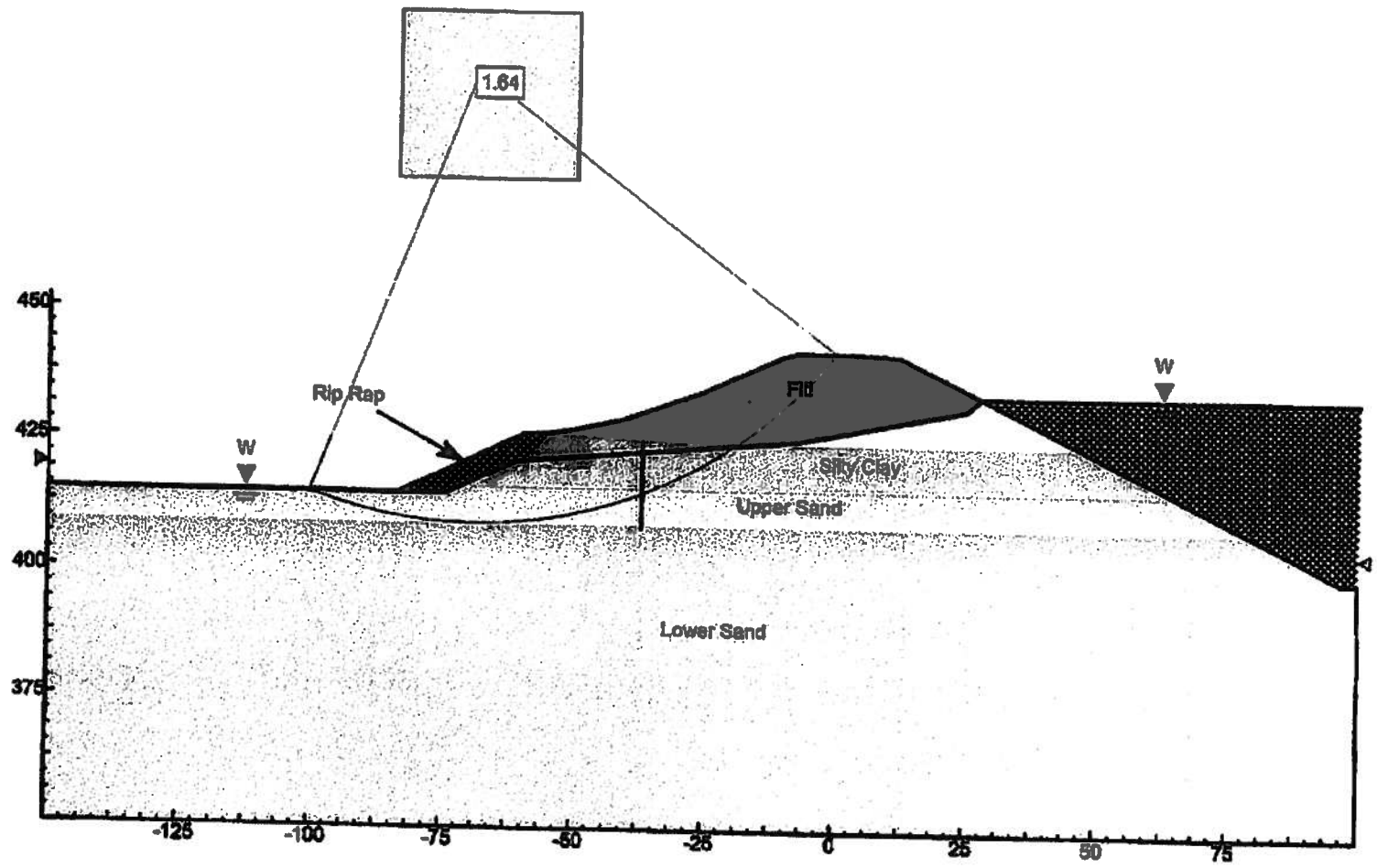

Ameren Missouri: Sioux Power Station
Long-term, Full Reservior
Cross-section 1

Reitz & Jens, Inc.

Figure 3

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Slide Analysis Information

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Document Name

File Name: x-sect 1 long term.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
GLE/Morgenstern-Price with interslice force function: Half Sine
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Silty Clay
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Figure 3

Water Surface: Water Table
Custom Hu value: 1

Material: Upper Sand
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Lower Sand
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Rip Rap
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 40 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

-55.000	426.500
-27.000	425.000
46.800	425.000

Material Boundary

-71.910	416.000
64.800	416.000

Material Boundary

-150.000	409.000
78.800	409.000

Material Boundary

-83.660	414.800
-74.400	414.800
-71.910	416.000
-57.800	422.750
-55.000	426.500

External Boundary

96.800	400.000
78.800	409.000
64.800	416.000
46.800	425.000
12.000	442.400
2.440	442.830
0.000	442.800

Figure 3

-7.400	442.830
-9.600	442.400
-25.700	434.900
-41.000	429.300
-51.100	427.100
-55.000	426.500
-59.600	426.300
-83.860	414.800
-150.000	414.800
-150.000	409.000
-150.000	350.000
100.000	350.000
100.000	400.000

Water Table

-150.000	414.800
-74.400	414.800
-61.113	421.104
-7.211	425.574
25.000	432.000
27.800	434.500
100.000	434.500

Focus/Block Search Line

-37.000	408.541
-37.000	424.998

Search Grid

-84.000	476.000
-50.000	476.000
-50.000	508.000
-84.000	508.000

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Figure 3

Material: Upper Fill
Unit Weight: 120 lb/ft3
Friction Angle: 27.5 degrees

Material: Clay 1
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 30 degrees

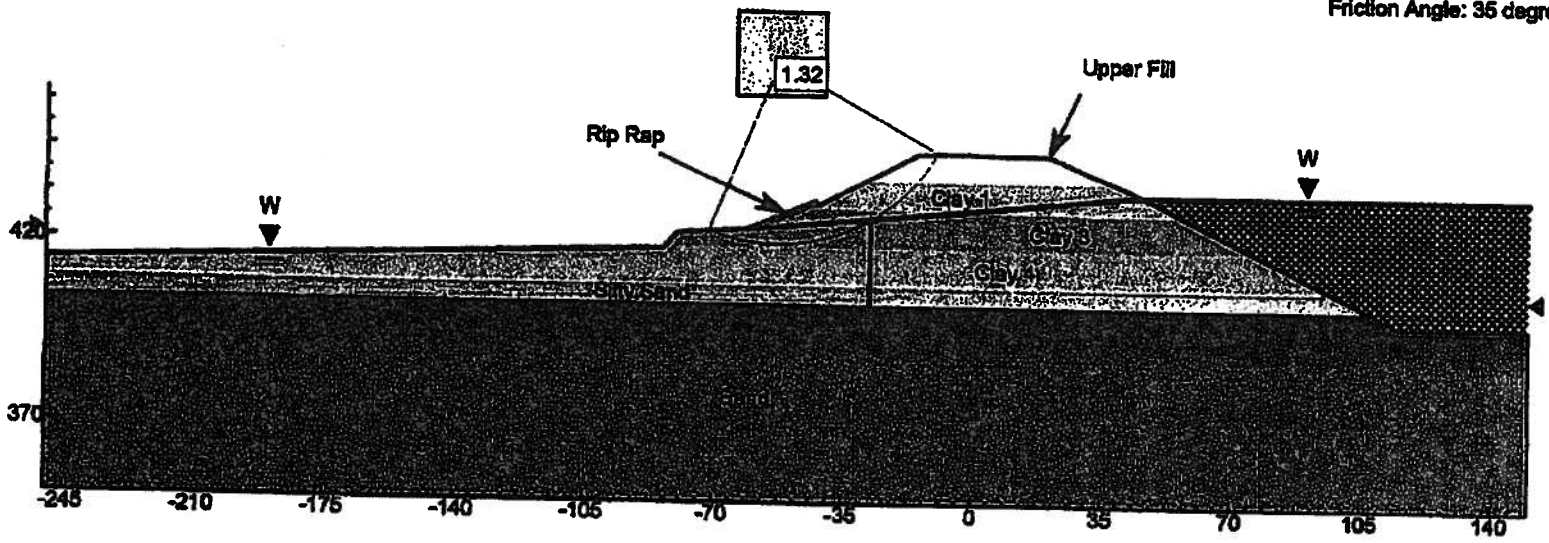
Material: Clay 3
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 28 degrees

Material: Clay 4
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees

Material: Silty Sand
Unit Weight: 120 lb/ft3
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 120 lb/ft3
Friction Angle: 35 degrees

Material: Rip Rap
Unit Weight: 110 lb/ft3
Friction Angle: 35 degrees



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Ameren Missouri: Sioux Power Station
Steady Seepage, Full Reservior
North Section

REITZ & JENS, INC.

Figure 4

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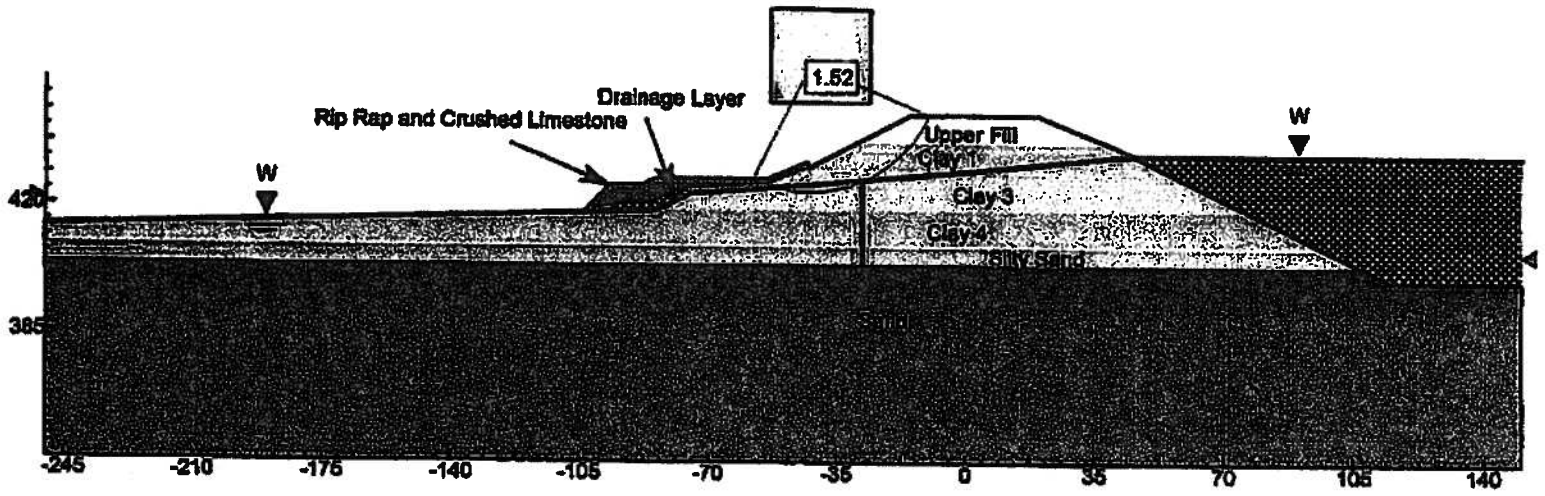

Ameren Missouri: Sioux Power Station
Steady Seepage, Full Reservior
North Cross-section

REITZ & JENS, INC.

Figure 6

Slide Analysis Information

CONFIDENTIAL

Document Name

File Name: fix x-sect north long term.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
GLE/Morgenstern-Price with interslice force function: Half Sine
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Upper Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 27.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay 1
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 30 degrees

Figure 5

Water Surface: Water Table
Custom Hu value: 1

Material: Clay 3
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 5 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay 4
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 350 psf
Friction Angle: 23.5 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Silty Sand
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Rip Rap
Strength Type: Mohr-Coulomb
Unit Weight: 110 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Drainage Layer
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

-29.264	437.995
38.340	437.800

Figure 5

Material Boundary
-44.824 429.976
-41.649 429.951
56.563 429.200

Material Boundary
-72.379 419.200
76.576 419.200

Material Boundary
-250.000 409.200
96.588 409.200

Material Boundary
-250.000 404.200
106.595 404.200

Material Boundary
-57.110 424.840
-44.824 429.976
-42.350 431.010

Material Boundary
-103.960 418.330
-94.100 418.660
-84.100 418.960
-83.620 419.200
-74.420 423.800
-63.650 424.449

Material Boundary
-94.100 418.660
-94.100 420.480
-84.990 420.750
-78.890 423.800
-74.420 423.800

Material Boundary
-83.620 419.200
-72.379 419.200

Material Boundary
-63.650 424.449
-57.110 424.840

External Boundary
-15.000 445.610
-29.264 437.995
-36.374 434.200
-42.350 431.010
-42.930 432.390
-53.923 427.798
-74.420 427.800
-83.360 427.800
-85.150 427.380
-87.680 426.120
-96.780 425.840

Figure 5

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-103.960	418.330
-250.000	414.000
-250.000	409.200
-250.000	404.200
-250.000	350.000
150.000	350.000
150.000	400.000
115.000	400.000
106.595	404.200
96.588	409.200
76.576	419.200
56.563	429.200
46.557	434.200
46.036	434.461
38.340	437.800
20.000	445.450
6.000	445.450
0.000	445.760

Water Table

-250.000	414.000
-103.960	418.330
-84.100	418.960
-74.420	423.800
-61.650	424.570
0.000	430.100
42.957	434.500
150.000	434.500

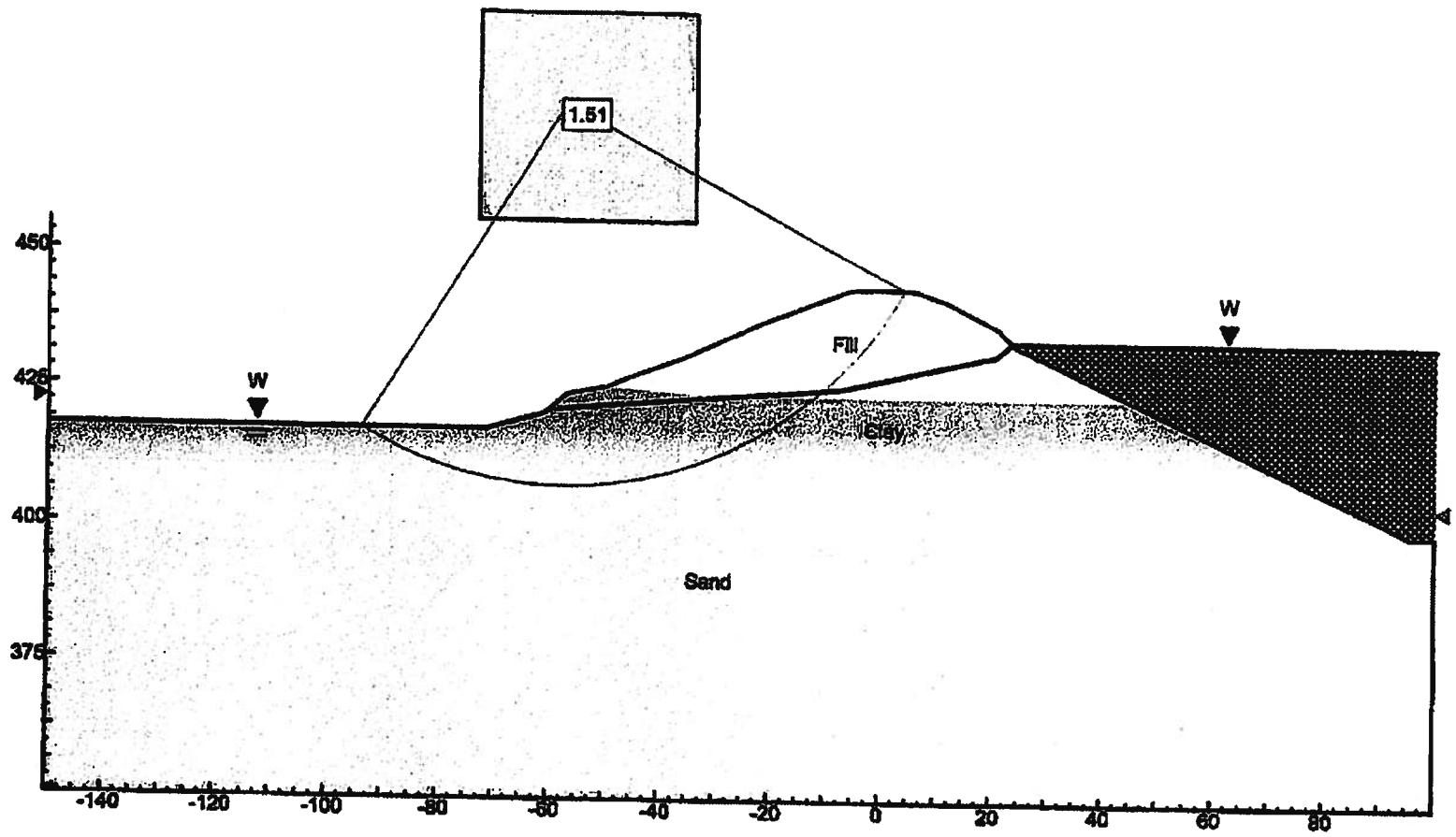
Focus/Block Search Line

-28.000	403.968
-28.000	427.210

Search Grid

-53.000	449.000
-28.000	449.000
-28.000	475.000
-53.000	475.000

Figure 5



Ameren Missouri: Sioux Power Station
Steady Seepage, Full Reservior
Cross-section2

Reitz & Jens, Inc.

Figure 6

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CONFIDENTIAL

Slide Analysis Information

Document Name

File Name: x-sect 2.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
GLE/Morgenstern-Price with interslice force function: Half Sine
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay
Strength Type: Mohr-Coulomb
Unit Weight: 112.8 lb/ft3
Cohesion: 200 psf
Friction Angle: 23.5 degrees

Figure 6

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Water Surface: Water Table
Custom Hu value: 1

Material: Sand
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

-49.700	425.500
-32.000	424.000
44.881	424.000

Material Boundary

-150.000	410.000
74.409	410.000

External Boundary

24.000	433.900
21.000	437.100
11.700	441.900
5.800	444.000
0.000	444.200
-5.100	444.000
-5.500	444.000
-7.100	443.500
-22.100	437.500
-36.200	430.800
-47.300	426.600
-49.700	425.500
-56.900	424.100
-60.800	420.600
-71.200	417.600
-150.000	417.600
-150.000	410.000
-150.000	350.000
100.000	350.000
100.000	400.000
95.500	400.000
74.409	410.000
44.881	424.000

Water Table

-150.000	417.600
-71.200	417.600
-60.800	420.600
-60.182	421.155
-7.211	425.574
20.600	432.000
23.438	434.500
27.800	434.500
100.000	434.500

Figure 6

CONFIDENTIAL

Search Grid	
-73.000	456.000
-33.875	456.000
-33.875	494.000
-73.000	494.000

Figure 6

Bcc: B. H. Novotny
M. K. Frerking
M. J. Tomasovic
M.C. Birk (w/o attach)
D. V. Fox (w/o attach)
K. P. Blank (w/o attach)
S. T. Garner (w/o attach)
R. R. Meiners (w/o attach)
T. L. Hollenkamp (w/o attach)
S. B. Knowles (w/o attach)
M. L. Menne (w/o attach)
S. C. Whitworth (w/o attach)
WM 3.11.3

APPENDIX B

Document 8

Photographs

1. **Looking at discharge to Bottom Ash channel from plant.**

2. **Looking at Bottom Ash channel from the plant discharge pipes.**

3. **Looking at the discharge pipes and channel.**

4. Looking West at inlet of permanent pool control device.

5. Looking at interior lined riprap slope problem.

6. Looking Northwest at North side of Bottom Ash Pond.

7. Looking at North side and Northeast corner of Bottom Ash Pond.

8. Runoff erosion in Bottom Ash Pond.

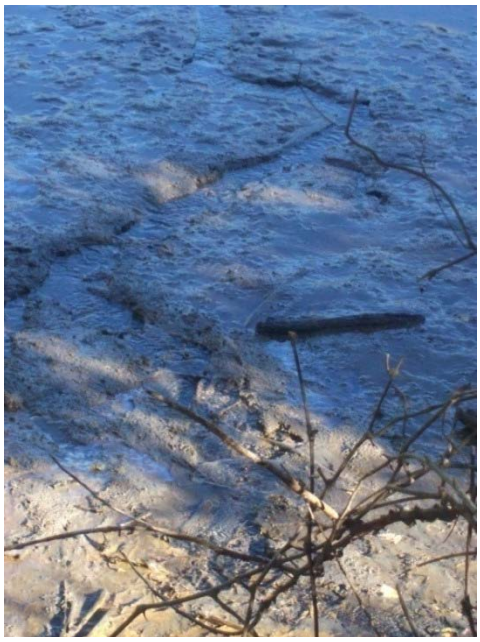
9. Top of embankment looking West. Note - Bottom Ash along embankment.

9A. Looking West along access road to bottom of embankment.

10. Looking West along embankment. Note – heavy vegetation along inside slope of embankment.

11. Seep location approximately 75' from toe of embankment and flows to the Mississippi River. Note – seep water is clear and being monitored by weekly inspection team.

12. Riprap on slope – repair of eroded area.



13. Seepage channel to Mississippi River.

14. Erosion area by riprap. Note - material looks like bottom ash.

15. Erosion area by riprap. Note - material looks like bottom ash.

16. Looking West where the riprap slope problem stops. Note - vegetation along bank.

17. Looking at North side of Bottom Ash Pond and slope protection.

18. Looking at North side of Bottom Ash Pond. Note - vegetation and riprap.

18A. Looking West at stream adjacent to the embankment. Inspection of bank are completed weekly/annual.

19. Looking North along embankment. Note - wide top width.

20. Looking South at inlet control structure.

21. Looking Southeast across Bottom Ash Pond.

22. Boring location for the stability analysis of embankment.

22A. Looking North along top of embankment and slope to channel.

23. Looking North at wide embankment section and North side of Bottom Ash Pond.

24. Looking at debris control device around inlet control structure.

25. Inlet control structure and emergency gate to stop discharge flow.

25A. Looking North at stream.

26. Note - wave action along bank.

27. Water surface measuring device at outlet control structure.

28. Looking Southeast along embankment.

28A. Looking Southeast along toe of embankment. Riprap placed after major tree removal activity.

29. Looking down embankment at riprap section along toe of embankment

30. Looking North across Bottom Ash Pond at the wider top width section along East side of pond.

31. Repair of eroded area lined with riprap.

32. Exterior slope along Southwest side lined with riprap.

33. Looking Southeast along top of embankment. Note - some maintenance area to reduce runoff erosion.

33A. Looking Northwest at toe of embankment.

34. Looking East along top of embankment. Note - area not considered part of embankment see photo 36.

35. Erosion area caused by surface runoff.

36. Looking West along access road and top of embankment. Note - area not considered part of embankment.

37. Maintenance of erosion area.

38. Looking East along access road.

39. Looking Southeast at Fly Ash Pond and location of inlet structure.

40. Looking at outlet pipe from Fly Ash Pond.

41. Look at access to outlet pipe from Fly Ash Pond.

42. Looking South along top of embankment. Note - railroad and access road to plant. Very wide top width is 75 yards.

43. Fly Ash Pond outlet erosion control to reduce velocity.

44. Looking East along interior of embankment. Note - Fly Ash Pond was lined in 1993.

45. Looking at West side of Fly Ash Pond.

46. Looking at debris control and measuring device at inlet structure.

47. Looking Southeast across Fly Ash Pond.

48. Looking South at embankment and lined slopes.

49. Looking at riprap that is used to repair surface runoff erosion.

50. Looking East across Fly Ash Pond.

51. Looking East along top of embankment. Note - railroad used 2-3 times a week for plant use only; 30' wide top width.

52. Looking at Northwest corner of Fly Ash Pond.

53. Looking at low wetland area and channel adjacent to toe of embankment.

54. Looking West along top of embankment.

55. Looking East along top of embankment. Note - top width increases for 2x the width of the South side of the Fly Ash Pond embankment .

56. Looking East along embankment. Top width is approximately 40'.

57. Looking North across Fly Ash Pond.

58. Looking at Southeast corner of Fly Ash Pond.

59. Looking Northeast along embankment. Note - wide top width.

60. Looking North along top of embankment.

61. Looking toward the area to the East of the embankment.

62. Looking Southeast at Fly Ash roadway.

63. Looking Northwest along embankment. Note - fill on both sides of embankment.

64. Looking at liner under fill material (Fly Ash).

65. Looking at construction staging area within Fly Ash Pond.

66. Looking South at channel in fill area. Note - channel flowing into pool area.

67. Outfall channel from plant into Fly Ash Pond.

68. Outfall pipes.

69. Outfall channel – Note - heavy Fly Ash in channel.

70. Looking along embankment and repair measures addressing runoff erosion.

71. Looking at pond embankment and liner. Note - fill material (Fly Ash) over liner.

72. Looking South along embankment.

73. Looking at Northwest corner of Fly Ash Pond.

APPENDIX C

Document 9

Fly Ash Pond Dam Inspection Check List Form

Site Name:	**Sioux**	**Date:**	**September 30, 2010**
Unit Name:	**Fly Ash Pond**	**Operator's Name:**	**AmerenUE**
Unit I.D.:	**Fly Ash**	**Hazard Potential Classification**:	**High** ☐ **Significant** ☐ **Low** X
	Inspector's Name:	Jeffrey Crabtree, PE and James Filson, PE	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly and Annually		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)? 9/30/10reading	440		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)? plans	434.5		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)? plans	441.5		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below): **See Note**		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		X	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		
17. Cracks or scarps on slopes?	X		24. Were Photos taken during the dam inspection?		

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments
#6	Pool elevation is recorded weekly.
#17	Minor erosion from runoff – evidence of erosion corrective measures part of action plan from weekly inspections
#21	Unable to inspect toe area due to wet low area South of unit
Note:	Liner installed in 1993, Railroad on embankment of units for facility use only

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit MO-0000353 **INSPECTOR**

Date 4/16/04 to 4/15/09
Impoundment Name Sioux

Impoundment Company AmerenUE
EPA Region Region 7

State Agency State of Missouri
(Field Office) Address Department of Natural Resources
Name of Impoundment Fly Ash

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X **Update** ☐

	Yes	No
Is impoundment currently under construction?	☐	X
Is water or ccw currently being pumped into the impoundment?	X	☐

IMPOUNDMENT FUNCTION: Storage and ph neutralization

Nearest Downstream Town Name: West Alton

Distance from the impoundment:

Location:

Latitude	38	Degrees	54	Minutes	30.25	Seconds	**N**
Longitude	90	Degrees	17	Minutes	27.32	Seconds	**W**

State Missouri **County** St. Charles

	Yes	No
Does a state agency regulate this impoundment?	☐	X

If So Which State Agency?

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

x **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

☐ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

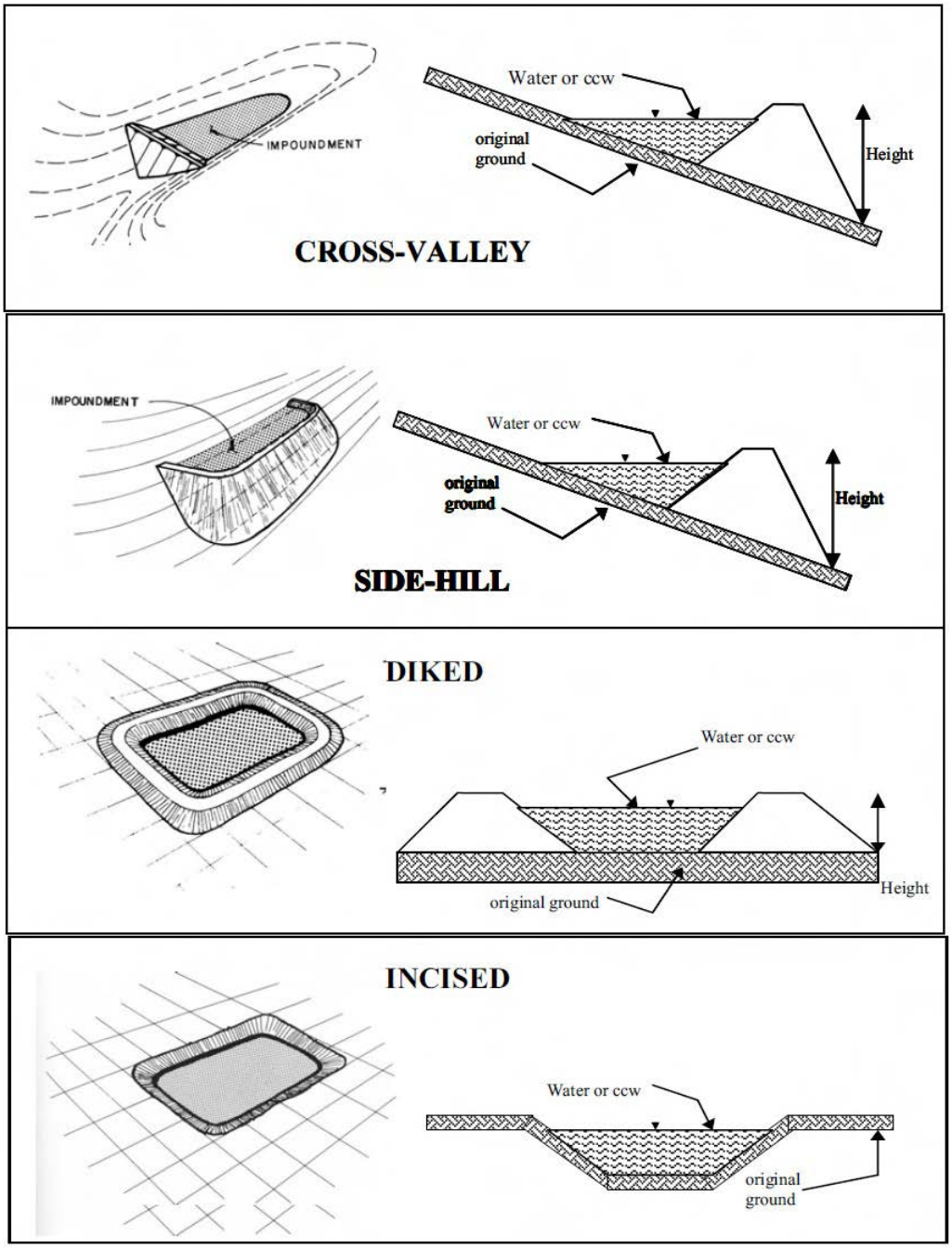
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Early assessment is determined to be low based on site assessment only. Visual assessment of unit was conducted and wet low (drainage swale for offsite area) area along the south side of this unit. AmerenUE has been monitoring this location as noted in their annual inspection report. Units and site in good conditions. AmerenUE has a dam safety group which oversees the unit and conducts weekly inspections.

The unit was lined in 1993 and a railroad track is along the top of the embankment. The railroad is used 2-3 times a week for coal deliveries. The embankment top widths are approximately 50-75 ft. AmerenUE are current conducting a stability analysis for this unit and final assessment of embankment will be determined once this report is reviewed. The report is anticipated to be completed by the end of the year.

CONFIGURATION:



☐ Cross-Valley ☐ Side-Hill X Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft)	22’	**Embankment Material**	Unknown –Stability Analysis to be completed by end of year
Pool Area (ac)	60’	**Liner**	Yes, Lined
Current Freeboard (ft)	2’	**Liner Permeability**	

TYPE OF OUTLET (Mark all that apply)

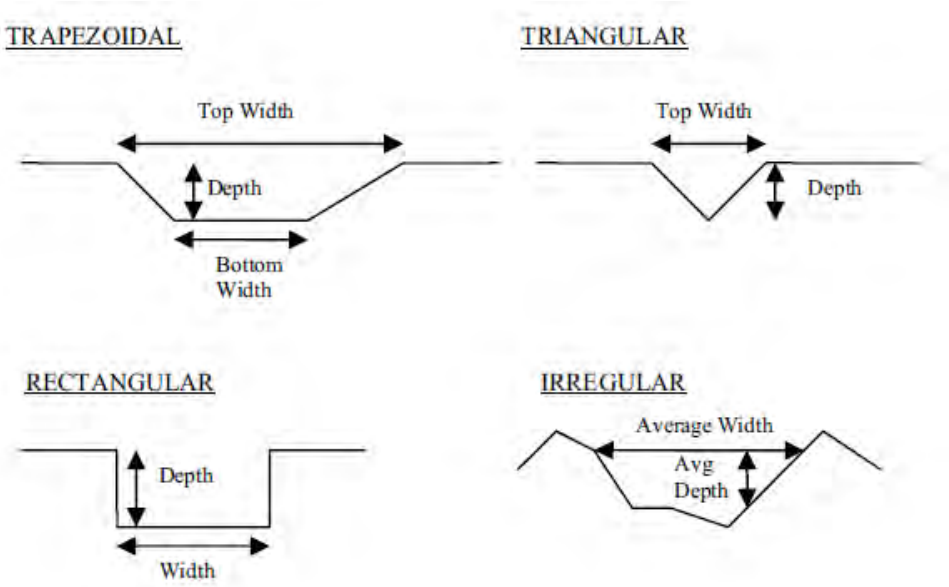
N/A **Open Channel Spillway**

- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

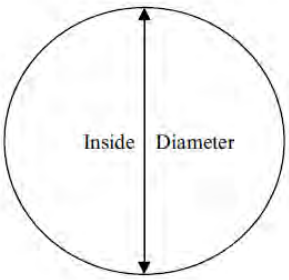
average bottom width (ft)

top width (ft)



X **Outlet**

18” inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- ☐ concrete
- X plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	X	☐

- ☐ **No Outlet**
- ☐ **Other Type of Outlet** (specify):

	Yes	No
Has there ever been a failure at this site?	☐	X

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	X
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	X
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

Not available – However, Stability Analysis of Unit will be completed by end of this year. Visible inspection did not see any issues, liner and slopes is good condition.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No – requested a copy of Stability Analysis for this assessment

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No-

APPENDIX C

Document 10

Bottom Ash Pond Dam Inspection Check List Form

Site Name:	**Sioux**	**Date:**	**September 30, 2010**
Unit Name:	**Bottom Ash Pond**	**Operator's Name:**	**AmerenUE**
Unit I.D.:	**Bottom Ash**	**Hazard Potential Classification:**	**High** ☐ **Significant** X **Low** ☐
	Inspector's Name:	Jeffrey Crabtree, PE and James Filson, PE	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Weekly and Annually		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)? 9/30/10 reading	434		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	plan		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	443		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	plans		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		X	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	X	
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments
#4	Spillway/Control – bulkhead with gate structure inside riser – Outfalls through a 30" pipe.
#9	Tree on embankment at end of "Embankment" embankment classification by AmerenUE Dam Safety Group based on not impounding water.
#12	No trash rack but floating device and area clear of debris
#17	Erosion in small areas (south side) and riprap placed a exterior (North and South sides) and interior (North and NW corner)
#19	Minor is areas – noted on weekly and annual report, being monitored.
#21	Seep in NE corner (Clearwater exiting from toe area) and AmerenUE are monitoring.

#23	West side – Channel adjacent to toe, unable to assess area. Incised channel flow adjacent to toe. This area is inspected by Ameren during their weekly and annual inspections.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit MO-0000353 **INSPECTOR**

Date 4/16/04 to 4/15/09
Impoundment Name Sioux

Impoundment Company AmerenUE
EPA Region Region 7

State Agency State of Missouri
(Field Office) Address Department of Natural Resources
Name of Impoundment Bottom Ash outfall 002

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X **Update** ☐

	Yes	No
Is impoundment currently under construction?	☐	X
Is water or ccw currently being pumped into the impoundment?	X	☐

IMPOUNDMENT FUNCTION: Storage and ph neutralization

Nearest Downstream Town Name: West Alton

Distance from the impoundment:

Location:

Latitude	38	Degrees	54	Minutes	46.62	Seconds	**N**
Longitude	90	Degrees	17	Minutes	42.43	Seconds	**W**

State Missouri **County** St. Charles

	Yes	No
Does a state agency regulate this impoundment?	☐	X

If So Which State Agency?

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

☐ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

x **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

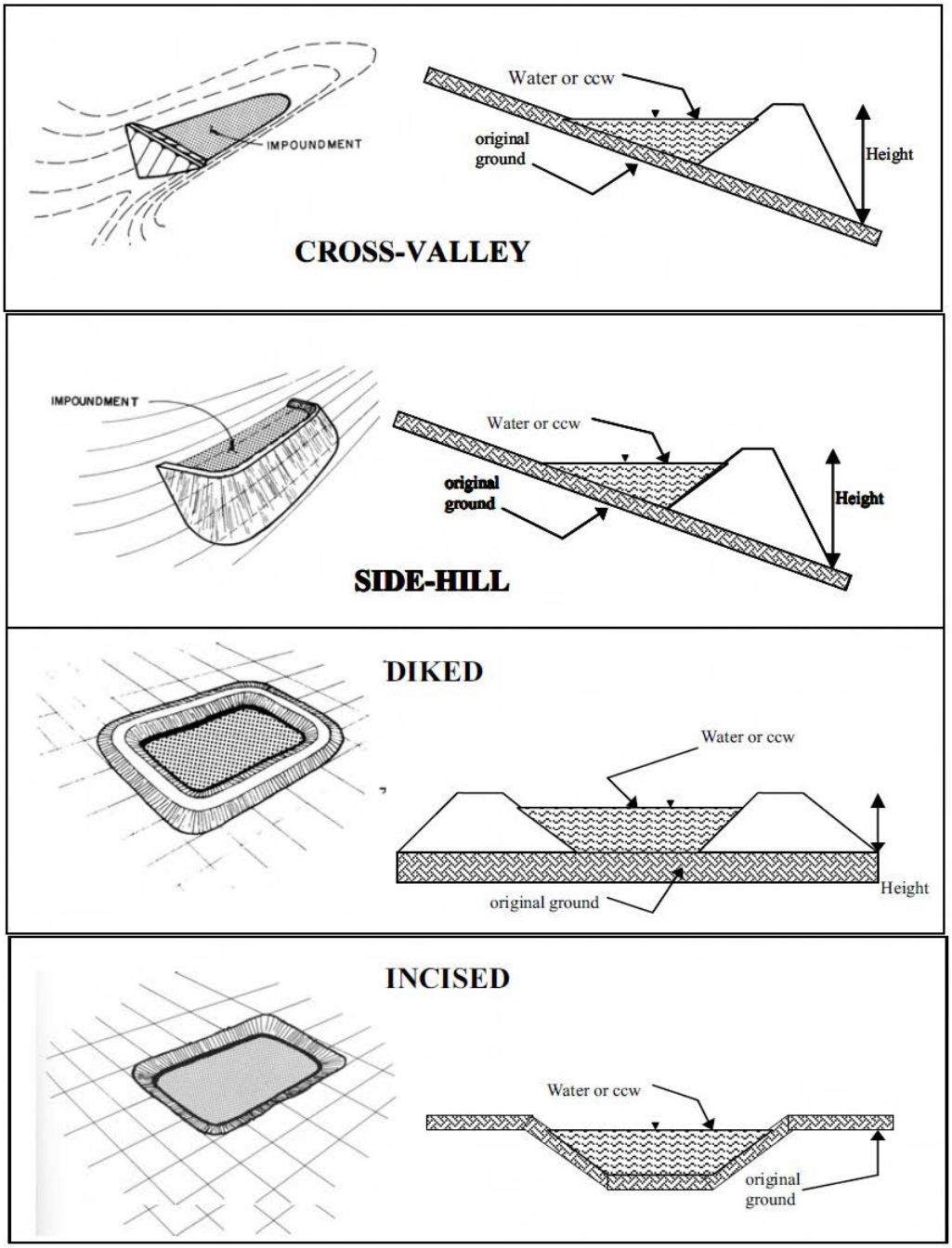
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Early assessment is determined to be appears to be low based on site assessment only; however, unknown embankment material pushes us to a significant hazard. Visual assessment of unit was conducted and site in good conditions. AmerenUE has been monitoring this location as noted in their annual inspection report. AmerenUE has a dam safety group which oversees the unit and conducts weekly inspections.

The unit is not lined. The embankment top widths are approximately 30-75 ft. The material of this embankment is unknown and unable to determine. AmerenUE is currently conducting a stability analysis for this unit and final assessment of embankment will be determined once this report is reviewed. The report is anticipated to be completed by the end of the year.

CONFIGURATION:



☐ Cross-Valley ☐ Side-Hill X Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft)	27’	**Embankment Material**	Unknown –Stability Analysis to be completed by end of year
Pool Area (ac)	47ac	**Liner**	No
Current Freeboard (ft)		**Liner Permeability**	

TYPE OF OUTLET (Mark all that apply)

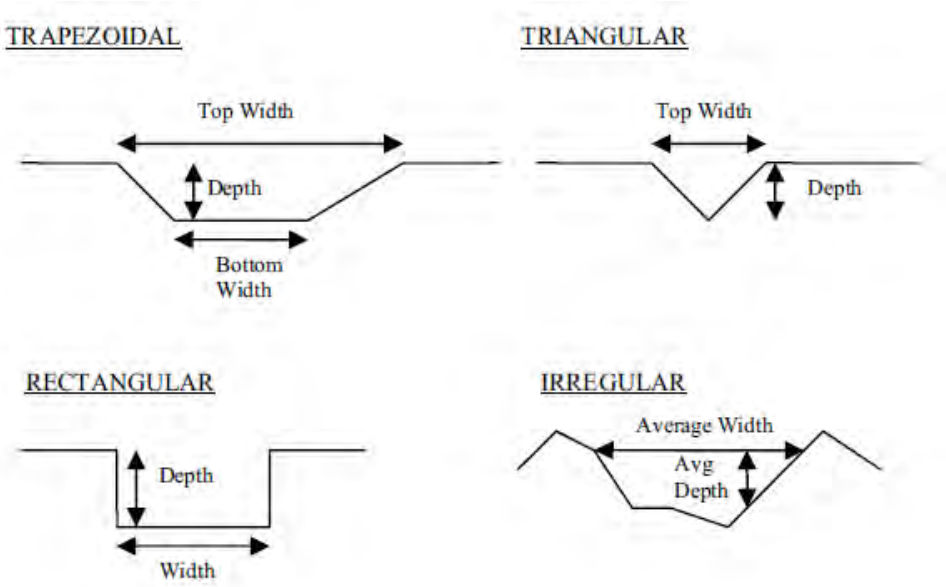
N/A **Open Channel Spillway** (Spillway tied to outlet pipe)

- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

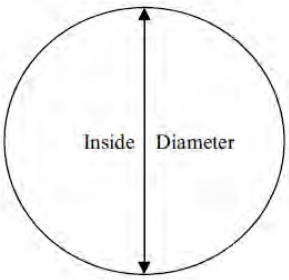
average bottom width (ft)

top width (ft)



X **Outlet**

30” inside diameter



Material

- ☐ corrugated metal
- ☐ welded steel
- X concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	X	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

	Yes	No
Has there ever been a failure at this site?	☐	X

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	X
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	X
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

Not available – However, Stability Analysis of Unit will be completed by end of this year. Visible inspection did not see any issues, liner and slopes is good condition.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No – requested a copy of stability Analysis for this assessment

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No-